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for precision
since 1888

WESTON

INSTRUMENT RELAYS

FOR MILITARY AND
COMMERCIAL APPLICATIONS

below 1000 200000

Instrument Relays are
designed to handle
a wide range of
control signals and
provide a reliable
means of control.

They are available
in a wide range of
types and sizes.

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ALL TYPES AVAILABLE.

Pivot and Jewel

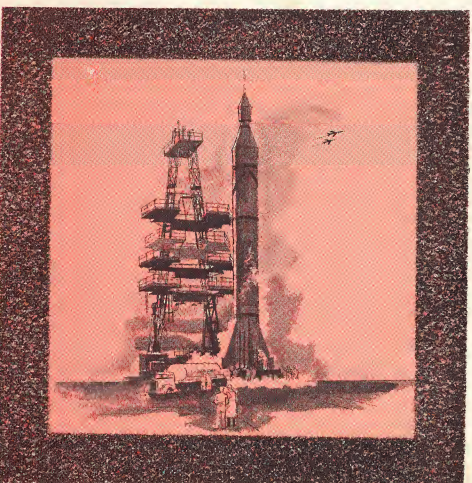
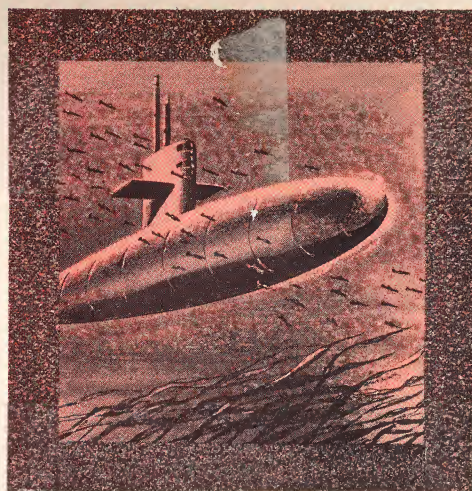
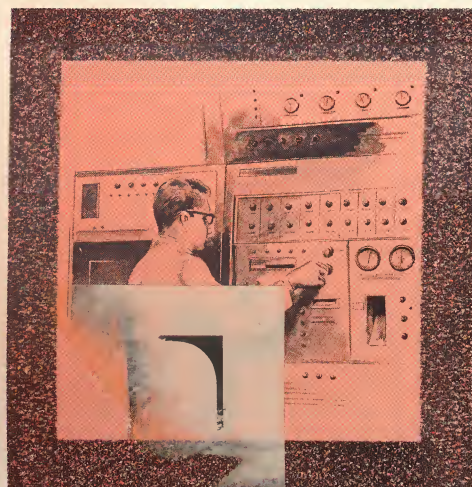
Taut Band

Magnetic Contact

Sensitive

Non Physical Contact

LCCA



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introduction

The instrument relay is a permanent magnet moving coil mechanism with contacts added to provide switching action. It can be used to sense either current or voltage and has found widespread applications for both control and alarm requirements. It is supplied in a variety of sizes and shapes and usually gives a visual indication as to the state of the system being controlled. The instrument relay is the most sensitive type of electro-magnetic relay and can be operated by micro-watt energy levels. This permits it to be used for sensing any condition which, by means of a transducer, can be converted to electrical energy. Even though the output of the transducer is small, a meter relay can often be used directly, thus eliminating the need for costly amplification.

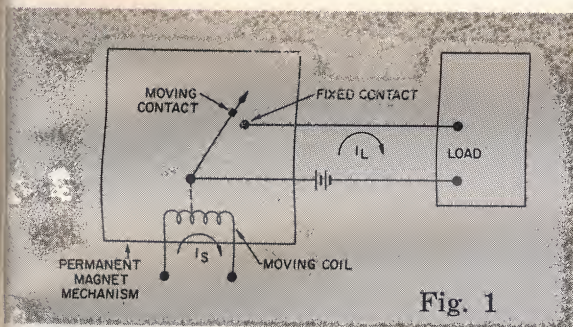
A schematic diagram of the simplest type of instrument relay is shown in Figure 1. It consists of a permanent magnet moving coil mechanism, which has a moving contact mounted on the pointer and a fixed contact rigidly mounted either to a stationary part of the instrument, or to a rotatable member which is adjustable from the front of the instrument. The fixed contact is mounted in the path of travel of the pointer so that the moving contact strikes the fixed contact when sufficient

current is applied to the terminals of the instrument, thus closing the load circuit. The load circuit is, of course, the circuit being controlled.

The first designs, known as the sensitive contact type, depended solely upon the current flowing through the moving coil for maintaining the contacts closed. In this type, the contact force is variable and, where only minute currents are available, the contact force is limited and the

contacts have a tendency to chatter and act erratically. To improve reliability and increase the scope of application, additional contact force was necessary. Additional contact force is provided by one of the following two methods:

1. The use of magnetic contacts or magnets to increase the contact force. Normally called a magnetic contact relay.
2. The use of an additional winding on the moving coil called an "aiding coil". This is known as a "load current contact aiding" relay (LCCA).



relay principles, construction & operation

The permanent magnet moving coil d-c mechanism is the heart of the instrument relay. There are two basic magnetic circuits effectively used today in permanent magnet moving coil mechanism applications. These include the external magnet design which is illustrated in Figure 2 and the internal magnet (or core magnet) design as shown in Figure 3. In the CORMAG*, the magnet itself is placed inside the moving coil to form the core of the mechanism and the outer magnetic return path is provided by a ring of soft iron. External magnet mechanisms permit extremes in deflectional sensitivity whereas the CORMAG* permits size reduction and self-shielding against external magnetic influence.

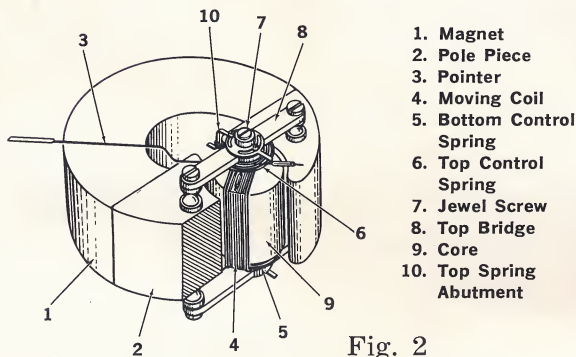


Fig. 2

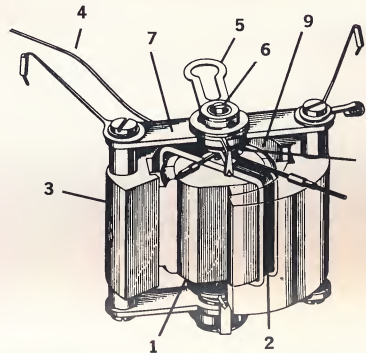


Fig. 3

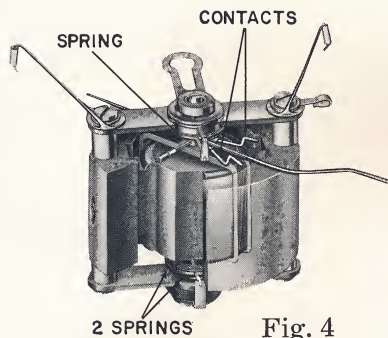


Fig. 4

The basic structure is altered as shown in Figure 4 to provide switching action. Moving contacts are mounted on the pointer and a third spring is mounted on the moving coil to provide electrical connection for the load current.

BALLISTICS

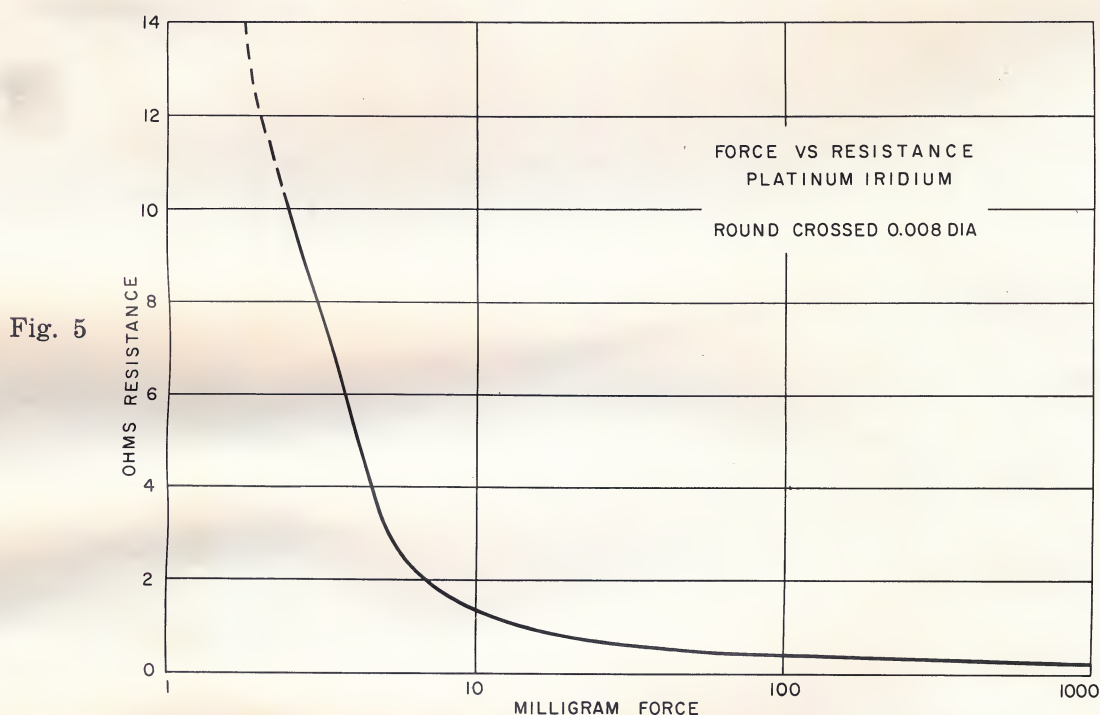
The ballistics of instrument relays are defined in terms of damping and response time. Instrument relays are generally designed to be critically damped or overdamped to avoid making spurious contact due to overswing of the pointer. Damping is obtained by: 1) The eddy currents induced in the metallic frame that supports the moving coil, and 2) the current that flows in the moving coil due to induced voltage, while the moving coil is in motion in the magnetic field. The degree of damping obtained from Point Number 2 is affected by the impedance of the source energizing the moving coil . . . the lower the source impedance the greater the damping.

*Trademark

The response time is directly dependent upon the damping and the particular mechanism under consideration. The ballistic characteristics of a given instrument may be varied by selecting proper moving coil frames, coil resistances and control springs to meet the needs of most applications.

RELAY CONTACTS

The reliability of an instrument relay depends upon the reliability of the contacts. A good contact may be defined as one which has a resistance below 2 ohms, and good mechanical wear characteristics. This, in turn, depends upon contact material, contact shape, contact force, the type of engagement of the contacts, cleanliness of the contacts, and the wiping action of the contacts as contact is made. These factors are functions of the circuitry associated with the contacts. Contact material, shape, engagement and wiping action are controllable by design and contact cleanliness is controlled by quality control procedures in manufacturing. Contact contamination which occurs after a period of time due to accumulation of films from airborne grease, dust, moisture, etc., is not controllable in an unsealed relay. This means that the mere touching of contacts is not sufficiently reliable and the importance of contact force must be emphasized. A general curve, shown in Figure 5, supports this by showing the reduction in contact resistance for an increase in contact force. Experience indicates that a 10 milligram contact force is necessary for reliable contact performance.



sensitive contact type instrument relays

Specific contact designs and methods of obtaining additional contact force are more fully described in the following sections which cover the various types of instrument relays.

The sensitive type relay depends solely upon the current flowing through the moving coil for maintaining the contact pressure. This means the contact pressure will vary as the

SENSITIVE CONTACT TYPE (continued)

current in the moving coil changes making this a poor relay to use where the current is very small or the current level varies widely after contact is made. It does have the advantage of being self-resettable as soon as the current drops below the contact set point.

CONTACT MATERIAL

In view of the limited amount of contact force available in a sensitive type instrument relay, the contact material should have a low resistance, should not form oxide films easily, and should be relatively flexible.

Two materials have been used most successfully: platinum-iridium and gold (used as a plating). Platinum-iridium is more generally used because of its hardness, low and uniform contact resistance, and high resistance to film formation and arc erosion. Gold, on the other hand, has a slightly lower contact resistance; however, it is softer than platinum-iridium and not as flexible. Generally, gold contacts wear out faster.

CONTACT DESIGN

Because of the relatively low contact force, the contact area must be kept small in order to provide maximum unit force. In addition, one of the contacts is made flexible to provide a wiping action which keeps contacts clean.

Various mechanical designs, such as a sharp-pointed contact closing against a flat surface produces a small contact area, however, one of the most satisfactory designs consists of two cylindrical rods which close at right angles giving a point contact as shown in Figure 6.

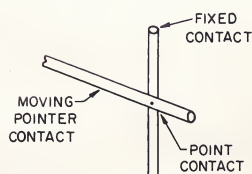


Fig. 6

In addition to point contact, this design gives a wiping action when flexible contact material is used.

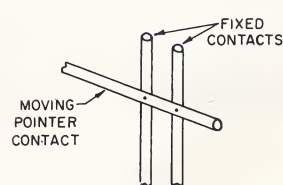


Fig. 7

To further improve the wiping action two cylindrical rods can also be used as the fixed contact as shown in Figure 7. In this design, the moving contact (the single rod) strikes on one rod of the fixed contact, bends it to the point where the moving contact makes contact with the second rod giving a wiping action as the movable contact slides over the surface of the fixed contact. By using two rods, more flexible cylindrical rods of smaller diameter may be used and the mechanical strength is still maintained.

CONTACT CAPACITY

The use of precious metals for contact material, coupled with low contact force, limit sensitive contact capacity to about 6 volts at 35 milliamperes (See specifications for details). At higher voltages electrostatic forces may cause premature attraction between the contacts and also produce metal-bridging effects. These factors will cause erratic operation at the higher voltage levels.

INSTRUMENT ACCURACY

The sensitive type of relay is not generally provided with an accurately calibrated scale and many have no scale. Where a scale is supplied, it is mainly used for a rough approximation of the variable being measured rather than for accurate measurement.

CONTACT ACCURACY

The sensitive type relay is not intended for precise alarm or control applications, resulting from slowly changing signals but is ideal as a triggering control or alarm, that is, where the moving coil current changes suddenly so that the contacts close with an impact.

CONTACT REPEATABILITY

The ability of the contacts to close repeatedly at the same predetermined value is dependent upon the particular application for which the relay is being used. If the contact force is sufficiently high, the repeatability may be as good as 1%. As the contact force is reduced, however, the repeatability inaccuracy becomes greater.

CONSIDERATIONS FOR APPLICATION

Even though the actuating current must be sufficient to maintain satisfactory contact force, a sensitive contact type instrument relay operates at current levels which generally do not require amplification. This feature coupled with the ability of the contact arm to float freely and "make" or "break" contact with a simple increase or decrease of the sensing current, have made it a useful relay. Its characteristics are such, that it should be used under conditions of fast make and break.

The following factors must be given careful consideration when specifying its use:

1. Areas with little or no vibration should be chosen when mounting.
2. Contact capacity should be limited.
3. Slow "make" and "break" operation should not be required as this will result in reduced life of contacts.

When these factors cannot be met, strong consideration should be given to the use of magnetic contact, LCCA, or Non-Physical Contact relays.

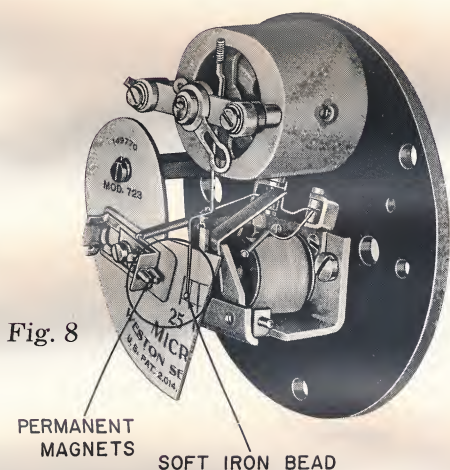


Fig. 8

magnetic contact type instrument relay

The magnetic contact relay is constructed similarly to the sensitive type relay except that the contact on the pointer is made of soft iron and the fixed contacts are small permanent magnets as shown in Figure 8.

OPERATION

This device operates in 2 stages as shown in Figure 9 and described below:

1. As current is applied to the moving coil, the pointer deflects toward the magnetic field of the permanent magnet.
2. When the soft iron pointer bead enters the magnetic field, it is attracted to the permanent magnet and closes the contact circuit.

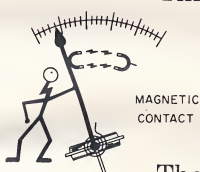


Fig. 9

The only current required is that necessary to deflect the soft iron bead contact into the magnetic field of the fixed permanent magnet contact.

MAGNETIC CONTACT TYPE (continued)

CONTACT FORCE

The contacts make solidly with a force of 2 to 3 grams, which is several hundred times greater than that obtained with a sensitive-contact type instrument relay of the same sensitivity. The increased force results in lower contact resistance and permits the device to be used where vibration is present without ill effects.

CONTACT MATERIAL

The movable contact is made of soft iron, heavily plated with silver and is solidly fastened to the pointer of the relay. The permanent magnet fixed contacts are made of workable magnetic material such as cobalt iron or cunife, which is also heavily plated with silver.

CONTACT DESIGN

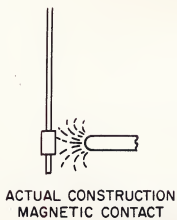


Fig. 10

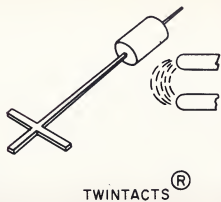


Fig. 11

Even though the contact force is considerably higher than that attainable in a sensitive contact type instrument relay, it is desirable to obtain maximum unit force. For this reason, the movable contact is made cylindrical in shape and the fixed contact has a spherical tip as shown in Figure 10 to give point contact.

Original designs consisted of a single magnet as shown in Figure 10, however, in later designs, it was found that improved performance resulted when the fixed contacts were supplied in pairs (called **twintacts**®) as shown in Figure 11.

These contacts are charged oppositely so that the movable contact is attracted by the field produced and comes to rest in a neutral position with the soft iron bead bridging both magnets. As the soft iron bead slides on the magnet surfaces, a wiping action is performed on the surface of the contact, removing contaminants and improving contact performance.

CONTACT CAPACITY

This type of instrument relay has a nominal contact rating of 100 milliamperes at 115 volts, a-c or d-c. The limiting factor is the spiral spring which completes the contact circuit. With special designs this capacity may be increased to 300 milliamperes.

INSTRUMENT ACCURACY

The magnetic contact type of relay is not generally provided with accurately calibrated scales and many have no scales. Where a scale is supplied, it is mainly used for a rough approximation of the variable being measured rather than for accurate measurement.

CONTACT ACCURACY

The contact accuracy is a function of the ability of the operator to adjust the magnetic contact set point. This can easily be adjusted to an accuracy of 5% or better.

CONTACT REPEATABILITY

Once the fixed contact has been set at the predetermined point within the specified limits, this type of relay will make contact at that point with a repeatability tolerance within 1%. It is this ability of the magnetic contact relay to repeat the preset value within 1% that is its greatest advantage to designers. Contact accuracy tolerance is less important since it is often possible to make minor adjustments within a system to compensate for the general accuracy tolerance.

CONTACT LIFE

This type of contact has a life greater than 10 million operations at rated current of 100 milliamperes and voltage of 115 volts a-c or d-c.

RELAY SENSITIVITY

Since the instrument movement will not be called upon to supply any contact force, it can be made more sensitive than the movement used in a sensitive contact relay. This means that a relatively small mechanism may be used with resultant saving in weight and size, even when high sensitivities are required. The actuating current can be low, which provides a power transfer (amplification ratio) of some 10^9 times the energy required to actuate the moving coil of the instrument. This is approximately 5,000 times greater than the ratio which can be obtained when using a sensitive contact relay.

RELAY RESET

When the magnetic contacts of the relay close, the restoring torque of the meter is insufficient to open them, therefore some auxiliary means of separating the contacts is necessary. Manual resetting or resetting by means of electrical solenoids are the methods employed. Some examples of these methods follow:

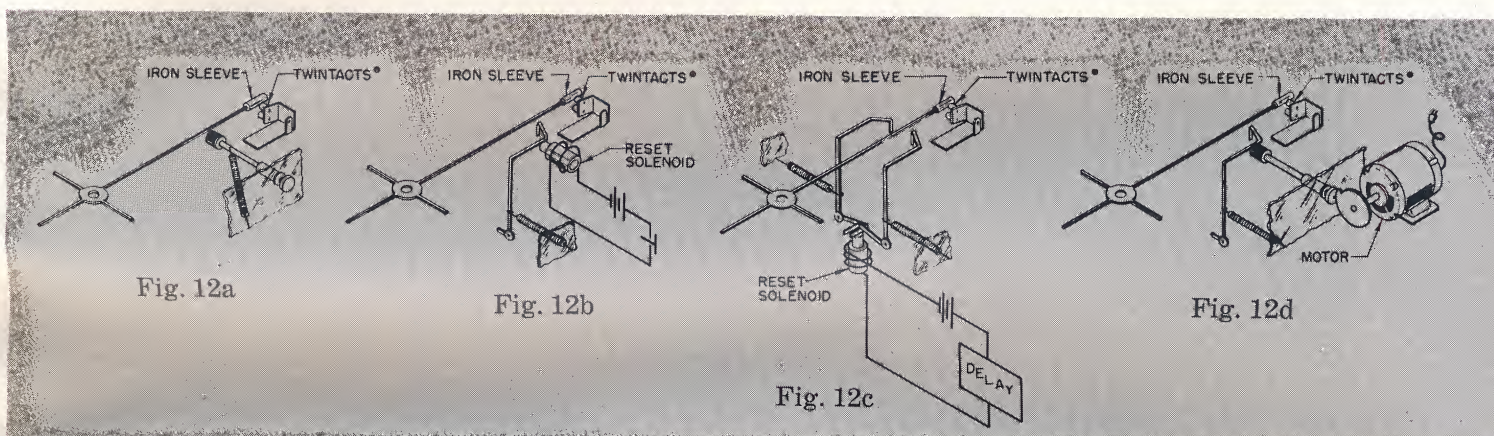


Fig. 12a Manual reset — a force is applied directly to the arm to break the contact.

Fig. 12b Remote push-button reset — to actuate a solenoid which mechanically breaks contact.

Fig. 12c Automatic reset — contacts are opened by a time-delay device operating the solenoid.

Fig. 12d Periodic reset — by use of a motor-driven cam.

CONSIDERATIONS FOR APPLICATIONS

In view of its ability to operate reliably even after extended periods of non-operation, the magnetic contact instrument relay has been used in more diversified applications than the sensitive contact type instrument relay. Its locking feature has permitted its use where vibration is present. It can operate at higher sensitivities since its contact force is not a function of the sensitivity. It has increased contact capacity and can switch A-C as well as D-C loads. An inherent feature in this design is that magnetic-contact instruments relays require reset.

This type of relay has a short deflection angle; therefore, its reading accuracy is limited. If greater accuracy of absolute values is required a long-scale instrument with lock-in control features should be used. (See LCCA section, Page 8.)

load current contact aiding relay (lcca)

This relay does not depend entirely on the sensing coil for contact pressure. The moving element of this type of relay contains an additional winding or locking coil wound on the same frame as the sensing coil and connected in series with the load as shown in Figure 13.

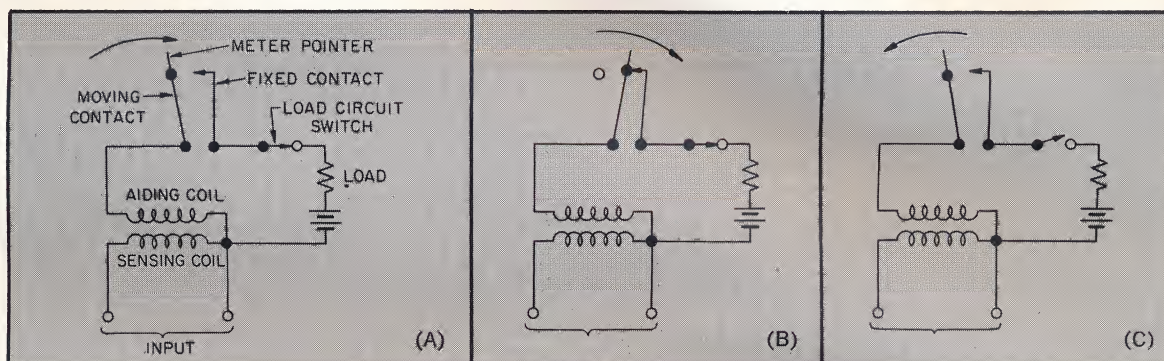


Fig. 13 The LCCA relay contains an aiding coil in the load circuit which is not energized as long as the pointer remains below setpoint (A). When the pointer reaches setpoint, the load circuit is completed (B), and the aiding coil provides an additional torque to maintain contact. The pointer no longer responds to the input signal. Reset occurs only when the load circuit is opened at another set of contacts (C). The spring torque assures a positive break.

When the sensing coil moves the pointer so it makes contact, the load circuit and the aiding coil are energized. The torque developed by the aiding (locking) coil increases and maintains contact pressure. The contact pressure which is developed is many times greater than that of a sensitive-type relay. This permits the LCCA relay to operate on smaller input signals, since it does not depend on the moving element current alone, to maintain contact.

A decrease in signal input will not break the contact. The load circuit must be opened to break the contact. This can be done: 1) manually, 2) with a timing motor, or 3) with a pulsing circuit. When the load circuit is broken, the spring loaded moving contact is driven down scale a short distance. If the signal is still above the preset value, the contact will remake.

The spring pressure on the contacts prevents sticking and allows operation at higher voltages and current than that allowable for sensitive relays. The LCCA relay is highly reliable and ideally suited to alarm systems or slowly changing input signals.

Reliability of the LCCA relay is a function of contact voltage and contact pressure. The contact pressure depends on the value of the load current and the number of turns in the aiding coil. Since the coils are designed for optimum pressure at a stated current, operating values of current should be specified rather than maximum values. If the coil requirements are overrated, contact pressure at normal operating currents may be insufficient.

Aiding coils are usually designed with a 100% overload safety factor for load current. Aiding coils may be dual (high and low) or single and several arrangements are possible as shown in Figure 14.

The Model 1073 MagTrak meter relay combines the high sensitivity of d-c permanent magnet indicating instruments, the reliability of magnetic contacts, and the locking and resetting features of the load current contact aiding type. Model 1073 features powerful initial contact pressure (100 times greater than most relays), fast make and break, single push button reset on front, set points readily adjustable and an auxiliary control package as a plug-in unit for remote mounting.

CONTACT CAPACITY

Nominal rating of the contacts in the LCCA type relay is 5-25ma at 24-125 volts d-c. The LCCA relay can operate with d-c loads only because the aiding coil requires direct current for proper operation.

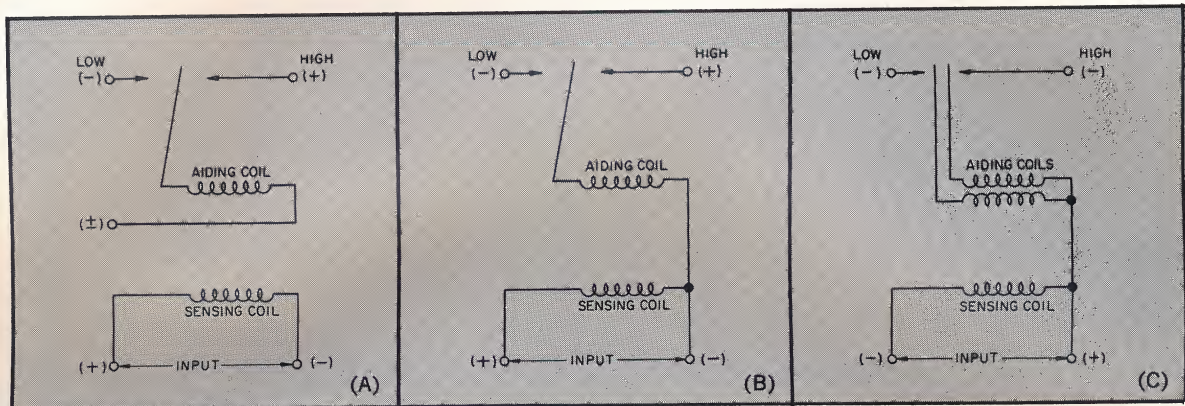


Fig. 14 Dual contacts (high and low) may be provided, with or without isolation of the aiding coil from the sensing coil, as in (A) or (B). The fixed contacts must be of opposite polarity so that the aiding coil torque is properly directed to maintain pressure on either contact. To operate a dual contact relay from a two-terminal power supply—both fixed contacts of same polarity—two aiding coils are required as in (C). These coils are wound in opposite directions to maintain the correct direction of force.

INSTRUMENT ACCURACY

The LCCA instrument can be supplied with an accuracy of 2% of full scale. Scale angles of 86° to 100° are provided with scale lengths equivalent to those of standard panel meters.

non-physical contact type relay

This is a new concept in the field of instrument relays. It is unique in that control is achieved without physical contact. Switching is accomplished by a system which may utilize a solid state switching circuit to eliminate the usual metal-to-metal relay contacts. Since contact is not made physically, automatic resetting is a fundamental part of the design. In addition, the pointer of the meter may continue to read beyond the set point after contact has been made.

The main components of this type of relay are: 1. a vane or light interrupter related to the pointer position 2. a photoconductive cell associated with the moveable index arm 3. a lamp circuit 4. fundamental switching circuitry.

OPERATION

Non-physical meter relays work on the principle of a changing photocell resistance with respect to the intensity of light illuminating that cell. Primarily the point at which the maximum change of cell resistance occurs is the point where the cell goes from a fully illuminated to a fully covered condition. It is at this point that meter-relay control functions may be initiated. The physical location of the index arm indicates the point at which switching action will occur. A typical operation cycle could be indicated by the following:

With lower and upper index arms located at the lower and upper ends of the meter scale, and with the moving coil energized to some intermediate reading, a change in the moving coil current which brings the pointer in line with either index arm will initiate switching action. The photocell resistance change is incorporated with additional circuitry which, in turn, operates a power relay or SCR circuit. Returning the moving coil to its intermediate position causes the unit to switch back to its former condition.

SENSITIVITY

When a taut band mechanism is employed as the meter mechanism a sensitivity of 10 micro-amperes can be achieved (see Model 1075 Page 32). Pivot and Jewel mechanisms have lower sensitivities (see Models 1930/1940, Page 34).

ACCURACY $\pm 2\%$ as a meter readout is standard. **LAMP LIFE** 8,000 Hours minimum (Model 1075) **DEAD ZONE** The difference in actuation point when the pointer is moving up or down scale is normally one degree or 1%.

optional features

SUPPRESSION CIRCUITS

All suppression statements in this catalog cover mechanical suppression of current and voltage (usually one (1) to two (2) scale lengths maximum as indicated by model). Voltmeter circuits requiring increased readability for particular control functions may have their scales expanded electrically (usually up to ten (10) scale lengths maximum), depending on range.

Electrical suppression is provided through the use of a zener diode bridge network. Voltage ranges as low as six (6) to eight (8) volts and up to 500 volts may be supplied having an accuracy of $\pm 0.5\%$ of mid-scale and temperature coefficient of $\pm 0.1\%$ per $^{\circ}\text{C}$.

MOUNTING

Standard mounting data will be found under specifications for each model. Special variations available upon request.

SCALES

Scale information will be found under specifications for each model. The standard practice is to have figures and caption agree with the measured quantity (i.e.: milliamperes or millivolts), but variations are available at a surcharge.

CONNECTION LEADS

Weston does not supply connection leads as a standard practice.

METER OVERLOAD PROTECTION

The basic meter movement is generally able to withstand a momentary overload of 10 times the full scale value without mechanical or electrical damage.

To provide meter protection, the meter circuit may be protected by a diode (usually silicon). The diode acts as a high impedance shunt until its point of conduction and at that time bypasses the overload current. These circuits are generally designed for each application.

relay selection chart

1. This chart indicates features available in a Model as a standard unit. On special order almost all features can be modified.
2. All features checked for a model are available, but not necessarily all at the same time. For example: zero center and suppressed zero cannot be provided simultaneously. For this reason features desired should be specified.
3. Applications are checked for conditions normally expected. A unit not checked does not mean impossibility, but rather inadvisability.
4. The term "Automatic" in the application section is used to mean self contained automatic reset when the input to the sensing coil is reduced. All models can be used with external circuits to provide automatic reset.
5. The chart is intended to narrow the choice to a few models. The catalog and/or the local Weston representative will assist in making the final decision as to the particular relay that best suits the use. Circuit diagrams are helpful in this respect. In addition to the features on the chart, all other details should be included, such as, mounting position, case style, specific range, scale caption, etc.

RELAY SELECTION CHART

CHARACTERISTIC	534	705	723	730	813 Sensitrol	813 Non-Locking	1073	1081	1085	1092	1093 LCCA	1097 LCCA	1075	1930	1935	1940	1945
SENSITIVITY Normal Max. Full Scale. Sensitivity in μ a DC given for zero left unit. Use as span for zero center i.e. 4 mics or 2-0-2. Greater sensitivity available depending upon conditions.	15	1	2	400	4	100	10	100	4	50	50	50	10	100	100	100	100
MECHANISM TYPES Magnetically Shielded Temperature Compensated Automatic Cold End Compensation Spring Back Jewels Miniature Size Sealed Unit (Watertight) High Vibration Resistance Taut Band	*	*	*	*	*	*	*	*	*	*	*	*	*	X	X	X	X
SCALES Calibrated Scales Scale Length 50° or more $\pm$ 2% Accuracy as Indicator Suppressed Zero Zero Center	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
CONTACTS Dual Contacts Adjustable Contacts 1% Repeatability Magnetic Contacts LCCA Contacts Non-Locking Contacts DC Contact Load 35 ma at 6 v DC Contact Load to 100 ma to 125 v DC Contact Load to 300 ma to 125 v AC Contact Load to 100 ma to 115 v Contact Life Expectancy over 5 Million Operations	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
APPLICATIONS DC Operation AC Operation. External Rectifier (E) Self Contained Rectifier (S) Automatic Control Sudden Change in Input Control, Slow Change in Input Alarm-Extreme Reliability Required (Contacts left unused long period of time) Photoelectric Uses	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

† With External Power Circuitry.

⊗ Except 100,000 at 5a, 115 V a-c.

* Available now.

X Available soon.

⊕ Contact life expectancy over 1,000,000 operations.

M LCCA contacts plus MagTrak.

how to order

WESTON RELAYS

GIVE THIS INFORMATION:

1. Model Number, CATNO (when listed) and Type Number.
2. High or low contact adjustment (or both) on "fixed" contact relays. If single contact, state whether contact is to be made on increasing or on decreasing values. (Note that on zero center meters, contact is always made on increasing values in either direction.)
3. Case (flush or surface).
4. Mounting position, if other than standard.
5. Resistance — if it is important.
6. If solenoid reset is required, state reset coil voltage, and whether AC or DC.
7. When ordering a thermocouple actuated temperature relay, state range in °F or °C, cold end temperature, material and resistance of the thermocouple and leads to be used with the relay. Also state if cold end compensation is required.
8. If same relay has been purchased previously, refer to previous order, or mark order "repeat", giving if possible some reference such as

previous sales order number, relay serial number, date, factory order(s) number, etc.

9. Where a special application is involved, it is of great assistance to have a circuit diagram showing where the relay is to be used. If auxiliary apparatus is employed, a complete description of it is very helpful.
10. For Model 1075, specify "WORK CURRENT" operation, if required.
11. Response time . . . if important.

In order to assure the best possible operation of a SENSITIVE or LCCA (Models 534, 730, 813, 1073, 1081, 1091, 1093, 1097) RELAY for any particular application, it is absolutely necessary that we be informed of the limiting conditions under which the relay is to be used. For example:

- What will be the values of voltage and current in the contact circuit?
- Is the circuit inductive or non-inductive?
- What are the values of resistance, inductance or capacitance, as known?
- Is any special accuracy required?

RELAY DISCOUNT SCHEDULE

1-4 Note 1	5-9 Note 1	10-24 Note 2	25-49 Note 2	50-99 Note 2	100-UP Note 3
0%	0%	10%	20%	33%	37%

Note 1 — Immediate or Future Delivery, but no extended shipping schedule.

Note 2 — Delivery schedule not to exceed a three month period, starting from date of initial part shipment.

Note 3 — Delivery schedule not to exceed a five month period, starting from date of initial part shipment.

ALL PRICES FOB NEWARK, NEW JERSEY, U.S.A. AND SUBJECT TO CHANGE WITHOUT NOTICE

sensitive relays

MODEL 534

GENERAL: Model 534 is Weston's finest sensitive (non-locking) contact relay. Widely used for many years, it can provide contact action on as little as 7.5 microamperes. Spring-like, rare metal contacts on the movable contact arm provide a wiping or self-cleaning action, and open or close without need for resetting mechanism.

To provide optimum performance, the Model 534 is engineered to meet the specific requirements of the particular application. It is available either as a voltage or as a current relay, suitable for portable use or switchboard mounting. Unless otherwise specified, relays will be adjusted for vertical switchboard mounting.

RANGES: Can be supplied self-contained with ranges as low as 7.5 microamperes or intermediate ranges up to 1 ampere. Higher ranges can be obtained through the use of appropriate 100 mv external shunts. Voltage ranges as low as one (1) mv can be supplied. Ranges of 50 volts or less are available in self-contained units. For ranges above 50 volts, external resistors may be required.

ACCURACY: See Range listing.

SCALE: None.

CONTACTS: Single or double contacts. Capacity is 50 ma at 6 volts d-c non-inductive. (Can be 200 ma on certain ranges.)

Suppressed Zero Type: High and low contacts are factory adjusted at specified current or voltage values of the same polarity. The minimum contact setting or the minimum difference between high and low contact settings is 7.5 microamperes. When used in controls to hold current or voltage to a desired value, the difference between high and low settings can be as little as 1% of the nominal value except for the more sensitive ranges.

Zero Center Type: Right and left fixed contacts are factory adjusted at the desired values of positive and negative polarity, with the moving contact between the two for zero current or voltage moving from zero only when the relay is energized. Minimum range contact settings are 7.5-0-7.5 microamperes.

ZERO SUPPRESSION: In general, maximum suppression available is 12 times the difference between high and low contacts. See listed ranges. (Please note that on suppressed zero or zero center current units, the range is considered to be the lowest value to close contact or the difference between the low and high contact, whichever is less.)

CASE STYLE: Surface case is standard.

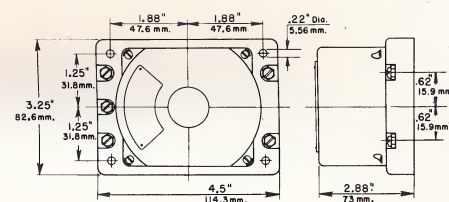
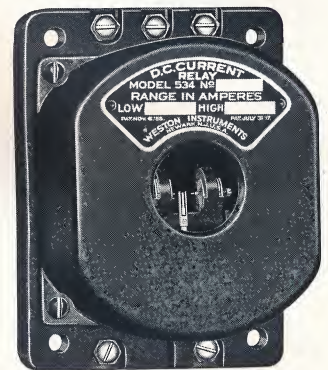
MOUNTING: Vertical panel mounting on non-magnetic panel is standard; units can be calibrated for magnetic panels on request.

RESISTANCE: See the values under Range listing.

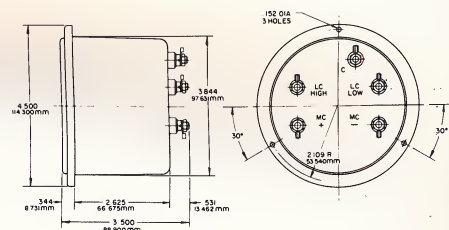
DIELECTRIC: 500 volts rms between circuits (test).

APPROX. WEIGHT: 2 lbs. (0.9 kg) (surface); 3 lbs. (1.36 kg) flush.

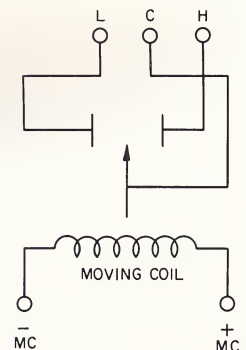
TERMINALS: Front connected screw type.



Surface Type



Flush Type •



Front View

(continued)

MODEL 534 (continued)

ZERO CENTER TYPES						
D-C Range	Resistance Ohms $\pm 20\%$	Accuracy % of Span	Recommended Volts on Contacts	D-C Contact Load ma	CATNO	Price [▲]
7.5-0-7.5 μa	4,100	5	6	35	534-1403001	\$107.25
25-0-25 μa	1,100	5	6	35	—	100.70
50-0-50 μa	1,100	2	6	35-200	—	95.00
100-0-100 μa	1,100	2	6	35-200	—	95.00
200-0-200 μa	690	2	6	35-200	—	95.00
500-0-500 μa	50	2	6	35-200	—	95.00
1-0-1 ma	25	2	6	35-200	—	93.00
5-0-5 ma	15	2	6	35-200	—	93.00
1-0-1 v	3,275	2	6	35-200	—	98.50
5-0-5 v	15,275	2	6	35-200	—	98.50
10-0-10 v	30,275	2	6	35-200	—	98.50
1-0-1 mv	0.9*	5	6	35	—	107.00
5-0-5 mv	0.9*	5	6	35	—	107.00
10-0-10 mv	1.8	2	6	35-200	—	105.00
50-0-50 mv	9.0	2	6	35-200	—	105.00
100-0-100 mv	18.0	2	6	35-200	—	100.00

*Resistance not temperature compensated

SUPPRESSED ZERO TYPE				
D-C Range	Resistance Ohms $\pm 20\%$	Accuracy ^{††}	CATNO	Price [▲]
7.5-15 μa [†]	4,100	$\pm 1.25 \mu a$	534-2403001	\$111.25
15-30 μa [†]	1,100	$\pm 2.5 \mu a$	534-2402001	107.25
100-200 μa	1,100	$\pm 12.5 \mu a$	—	104.70
500-550 μa	1,100	$\pm 12.5 \mu a$	—	104.70
450-850 μa	690	$\pm 20 \mu a$	—	99.00
200-800 μa	275	$\pm 20 \mu a$	—	99.00
1-2 ma	50	$\pm 0.07 ma$	—	97.00
5-7 ma	25	$\pm 0.15 ma$	—	97.00
5.9-6.1 v	2175 ($\pm 5\%$)	$\pm 0.1 v$	—	102.00
40-42 v	5025 ($\pm 5\%$)	$\pm 0.25 v$	—	102.00
1-2 mv [†]	0.9**	$\pm 0.1 mv$	—	111.00
5-10 mv	0.9**	$\pm 0.4 mv$	—	109.00
10-20 mv	1.8	$\pm 0.8 mv$	—	109.00
100-200 mv	1.8	$\pm 8.0 mv$	—	99.00

^{††}Repeatability will be well within accuracy limits.

[▲]Prices shown are for surface type plastic cases; flush metal can be supplied at \$7.50 additional.

[†]Contact load on these ranges is 6 volts, 35 ma d-c; all other ranges 6 volts at 35-200 ma d-c.

**Resistance is not temperature compensated.

For unlisted ranges add \$2.00 list to next highest range.

sensitive relay

MODEL 730

GENERAL: Model 730 is a sensitive indicating relay which eliminates the need for a separate milliammeter in the circuit. Designed for operation when normally flowing current either increases or decreases beyond a predetermined value. It is generally used in closed alarm systems such as banks, fire and police alarm circuits. Model 730 can be engineered to meet the specific requirements of a particular application.

RANGES: As high as 1/2 amp self-contained, higher current ranges available through use of appropriate 100 mv shunt. Voltage ranges from as low as 100 mv to as high as 150 volts can be supplied self-contained; higher ranges available through use of external resistance.

ACCURACY: $\pm 5\%$ of full scale value.

SCALE: The normal scale angle is 40° (.92").

CONTACTS: Single or double fixed contacts. Recommended contact load is 6 volts at 35 ma d-c. The contact circuit is insulated from the moving coil circuit. On those applications wherein a high and low contact is desired, the lower contact will be set 10% up scale for current pull-in. It cannot be set at the zero mark since no pull-in torque exists at this point.

ZERO SUPPRESSION: 5 scale lengths maximum.

CASE STYLE: Flush type is standard. Surface case available. The front cover can be removed from the flush type case for adjustment of contacts or zero correction without removing the relay from the panel.

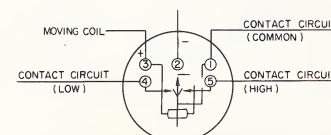
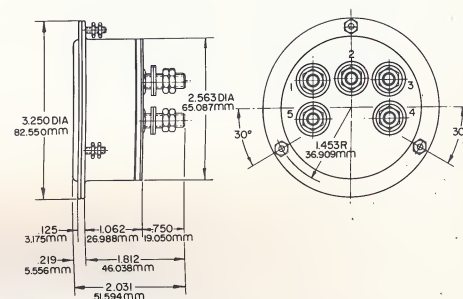
MOUNTING: Vertical panel mounting is standard.

RESISTANCE: See Range listing.

DIELECTRIC: 500 volts rms between circuits (test). 500 volts rms between case and all circuits tied together (test).

APPROX. WEIGHT: 0.85 lbs. (0.39 kg)

TERMINALS: BC studs.



Front View

RANGES					
D-C Range	Resistance Ohms $\pm 20\%$	CATNO	Price* Fl. Case	CATNO	Price* Surf. Case
0-200 μ a	7,400	—	\$84.00	—	\$81.90
0-250 μ a	3,080	—	83.50	—	80.90
0-500 μ a	1,030	—	80.25	—	77.65
0-1 ma	285	—	78.85	—	76.25
0-1.5 ma	135	—	78.85	—	76.25
0-4 ma	14	730-9101001s	78.85	730-9201001	76.25
0-2 v	1,000 Ω /v	—	83.00	—	80.40
0-10 v	1,000 Ω /v	—	83.00	—	80.40
0-100 v	1,000 Ω /v	—	83.00	—	80.40
0-150 v	1,000 Ω /v	—	83.00	—	80.40
0-100 mv	1,000 Ω /v	—	—	—	—

*Above prices are for single or double contacts.

s-Normally carried in stock.

For unlisted ranges add \$2.00 list to next highest range.

All dimensional diagrams approximate.

miniature sensitive relay

MODEL 813

GENERAL: The miniature Model 813, modern and compact, provides many advantages of other relays, with added versatility and ruggedness. With the addition of spring-back jewels it is more reliable than ever and its small size, light weight and tested sturdiness make this relay adaptable for airborne, marine, and portable uses as well as switchboard applications.

This relay is not intended for precise alarm or control applications, but is designed for a triggering alarm or control wherein the moving coil current changes quickly in order that the contacts close with a sharp impact. It is not recommended for a-c operation.

RANGES: See listing.

ACCURACY: $\pm 10\%$ of span.

SCALE: None.

CONTACTS: Sensitive type can handle contact load of 35 milliamperes at 6 volts d-c. Contacts have rare metal surfaces and are non-magnetic and self-resetting.

ZERO SUPPRESSION: Approximately 10 to 15 times depending upon contact setting.

CASE STYLE: Base is thermosetting plastic and cover is transparent plastic.

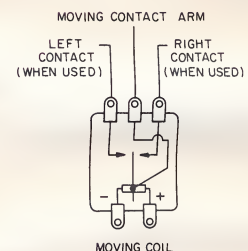
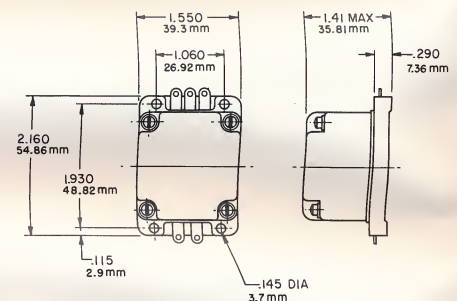
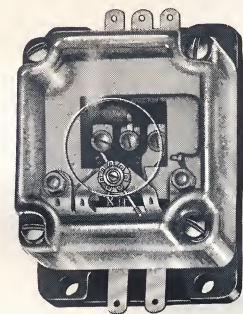
MOUNTING: Vertical panel mounting, surface type, front connected.

RESISTANCE: See Range listing.

DIELECTRIC: 500 rms between circuits (test).

APPROX. WEIGHT: 3.5 oz. (0.10 kg)

TERMINALS: Solder type.



RANGES			
D-C Range	Resistance Ohms $\pm 20\%$	CATNO	Price
25-0-25 μa	3,150	—	\$44.00
50-0-50 μa	1,000	813-9968001s	42.35
100-0-100 μa	555	—	41.50
200-0-200 μa	140	—	41.50
500-0-500 μa	65	—	41.50
1-0-1 ma	12	—	40.50
2-0-2 ma	7.5	—	40.50
5-0-5 ma	3.2	—	40.50
10-0-10 ma	2.1	—	40.50
20-0-20 ma	2.1	—	40.50
1-0-1 v	1,000 Ω/v	—	41.25
25-0-25 v	1,000 Ω/v	—	41.25
50-0-50 v	1,000 Ω/v	—	41.25
100-0-100 v	1,000 Ω/v	—	41.25
50-0-50 mv	500 Ω/v	—	41.50
100-0-100 mv	1,000 Ω/v	—	41.50

s—Normally carried in stock.

For unlisted ranges add \$2.00 list to next highest range.

All dimensional diagrams approximate.

miniature sensitive hermetically sealed relay

MODEL 1081

GENERAL: Model 1081 relay is ideal for applications where weight and small size are important, or where external electro-magnetic effects must be held to a minimum.

RANGES: See listing. Others available.

ACCURACY: $\pm 10\%$ of span.

SCALE: None.

CONTACTS: Double contacts with capacity of 35 milliamperes at 6 volts d-c non-inductive at high sensitivity; loads up to 0.5 amperes at 28 volts d-c, non-inductive can be handled depending upon moving coil sensitivity and number of operations.

ZERO SUPPRESSION: Approximately two (2) scale lengths, depending on range.

CASE STYLE: Housed in a brass, tinned finished case. "Mu-metal" cases for maximum shielding can be supplied; unless otherwise specified surface, brass cases will be supplied.

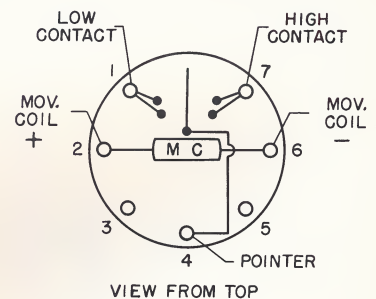
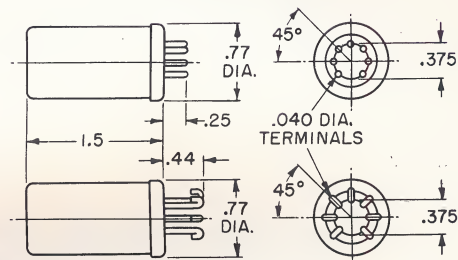
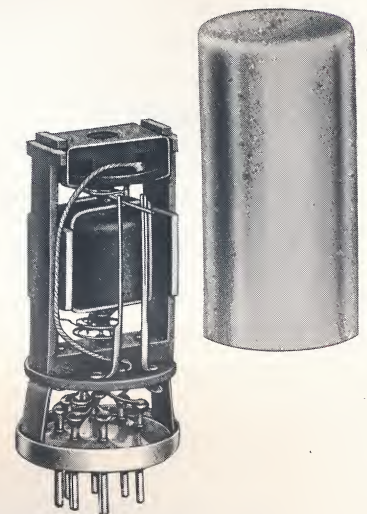
MOUNTING: Upright mounting is standard. (Base horizontal.)

RESISTANCE: See Range listing.

DIELECTRIC: 350 volts rms between all circuits tied together and case; and between the moving coil circuit tied together and the contact circuits (test).

APPROX. WEIGHT: 1.1 oz.

TERMINALS: Miniature 7 pin header, or hooked solder type terminals.



RANGES				
Range	Resistance Ohms $\pm 20\%$	CATNO	Terminal Type	Price
50-0-50 μ a	2,300	1081-9902001s	Contact Pin	\$44.55
50-0-50 μ a	2,300	1081-9902002s	Solder Term.	44.55
1-0-1 ma	50	—	Either Type	43.00
5-0-5 ma	6	—	Either Type	43.00

s-Normally carried in stock.

For unlisted ranges add \$2.00 list to next highest range.

sensitrol[®] relays

MODEL 705

GENERAL: These relays are highly sensitive to the most minute changes in current or voltage and have remarkably high contact capacity. The Model 705 is ideal for countless applications requiring reliable electrical response to initiate alarms or to achieve ultra-sensitive control. Positive and accurate operation can be obtained as low as five microamperes with a 2300 ohm moving coil. For even greater sensitivity, Type N is recommended with ranges as low as $\frac{1}{2}$ -0- $\frac{1}{2}$ microampere at 7400 ohms.

These relays can be supplied with various contact arrangements to operate on either increasing or decreasing values.

RANGES: See listing.

ACCURACY: $\pm 5\%$ of scale span for Types 1, 2 and 3; $\pm 10\%$ for Types 4, 5, 6 and N.

SCALE: See "Description of Types."

CONTACTS: Single, double, adjustable and fixed (see "Description of Types"). Contact capacity of Types 1, 2, and 3 is 50 ma at 120 volts a-c or d-c. Types 4, 5, 6 and N which use TWINTACTS[®] are rated at 100 ma at 120 volts a-c or d-c.

ZERO SUPPRESSION: Zero can generally be suppressed four to ten scale lengths, depending on deflection angle.

CASE STYLE: Plastic or metallic. Surface (metallic) will be provided unless other specified on order.

MOUNTING: Flush or surface, vertical panel mounting.

RESISTANCE: See Range listing.

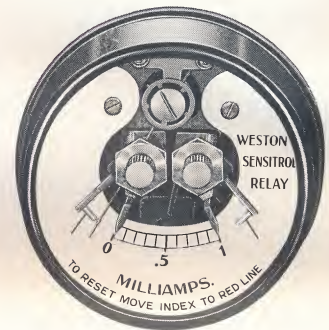
DIELECTRIC: 500 volts rms between all circuits and between terminals and case (test).

APPROX. WEIGHTS: Type 1, 0.74 lb. (0.34 kg); Type 2, 0.73 lb. (0.33 kg); Type 3, 0.73 lb. (0.33 kg); Type 4, 0.85 lb. (0.39 kg); Type 5, 0.85 lb. (0.39 kg); Type 6, (Flush) 0.7 lb. (0.32 kg); Type 6 (Surface) 0.7 lb. (0.32 kg) exclusive of 1.6 oz. (0.05 kg) solenoid; Type N, 1.3 lb. (0.59 kg).

TERMINALS: B.C. Studs, except Type N.



Type 1



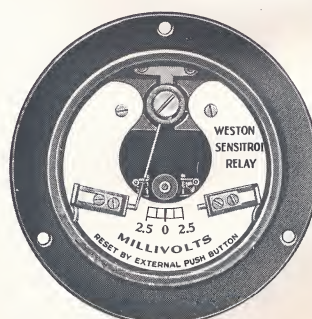
Type 3



Type 3S



Type N



Type 6



Type 5

DESCRIPTION OF TYPES

Type 1 — Single Fixed Contact with Manual Reset. Stationary contact remains in fixed position on left side of scale. Supplied to make contact on either increasing or decreasing values (state which). Reset manually by a knob on the front or a lever on the back. Scale length approximately 30° or .6 inch. Minimum current for full scale deflection is 10 microamperes.

Type 2 — Single Adjustable Contact with Manual Reset. Stationary contact can be adjusted over half of scale by means of knob on front which is also the reset control. Supplied to make contact on either increasing or decreasing values, (state which). Provided with a movable index to show the operating point. Scale length approximately 50° or 1 inch. Minimum current for full scale deflection 10 microamperes.

Type 2S— Same as Type 2 except with separate contact adjusting and reset controls. This relay may be reset without disturbing the operating point of the relay. Scale length is approximately 38°.

Type 3 — Double Adjustable Contacts with Manual Reset. Has two adjustable stationary contacts, one for high and one for low values. Provided with two indexes for indicating high and low operating points. Contacts adjusted and reset by knobs on front. Closest that contacts can be set together is 30% of scale length. Scale length approximately 50° or 1 inch. Minimum current for full scale deflection is 10 microamperes.

Type 3S — Same as Type 3 except with separate contact adjusting and reset controls. This relay may be reset without disturbing either high or low operating point. Scale length is approximately 38°.

Type 4 — Single Contact with Solenoid Reset. Uses Twintacts. Supplied to make contact on either increasing or decreasing

values (state which). Scale length approximately 20° or .4 inch. Minimum current for full scale deflection is 5 micro-amperes.

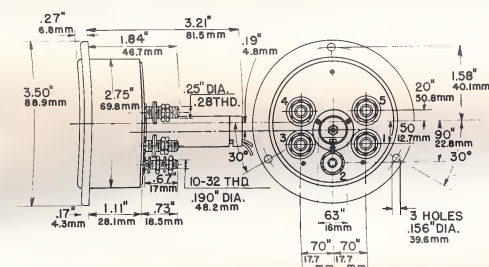
Type 5 — Single Contact with Solenoid Reset and Adjustable Operating Point. Similar to Type 4 but contact making value is adjustable over the full scale by means of an adjustable index which shifts the control spring similar to the action of a zero corrector. Because of this type of adjustment, the pointer is not necessarily a direct indication of the coil current. Has two scales, a red one for setting the index to the value at which contact is to be made, and a black scale which indicates the change in coil current or voltage necessary to achieve the contact making value. The stationary contact is always on the left side of the scale, but can be supplied to make contact on either increasing or decreasing values (state which). Scale length approximately 20° or .4 inch. Minimum current for full scale deflection is 5 microamperes.

Type 6 — Double Contact with Solenoid Reset. Uses Twin-tacts. Makes contact on both increasing and decreasing values. Scale length 15° or .3 inch. Minimum current for full scale deflection is 5 microamperes.

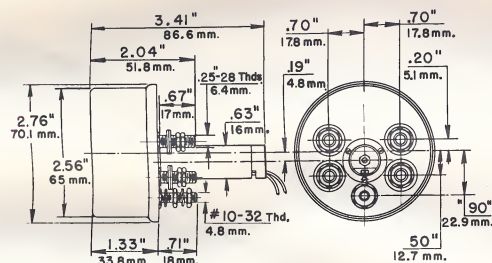
Type N — Double Contact with Solenoid Reset. Has Twintacts at each end of scale for increasing and decreasing values. Designed for applications calling for maximum sensitivity. Slightly larger than other Model 705 Relays, Type N is supplied in surface metal case only. Scale length 15° or .3 inch. Minimum current for full scale deflection is 1 microampere.

NOTE: Model 705 Solenoids are mounted permanently on back of relay, extending about 2" and are available for 6 volts d-c or 120 volts 60 cycle a-c service, but can be supplied for other d-c or a-c service at a surcharge.

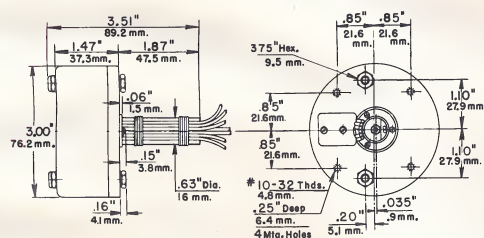
When ordering Model 705 Relays, use type numbers printed above and when zero left or suppressed zero, specify whether contacts are to close on increasing or decreasing values or both. Note that if zero center, contact is made on increasing values in each direction.



Type 6 * — Flush Case.

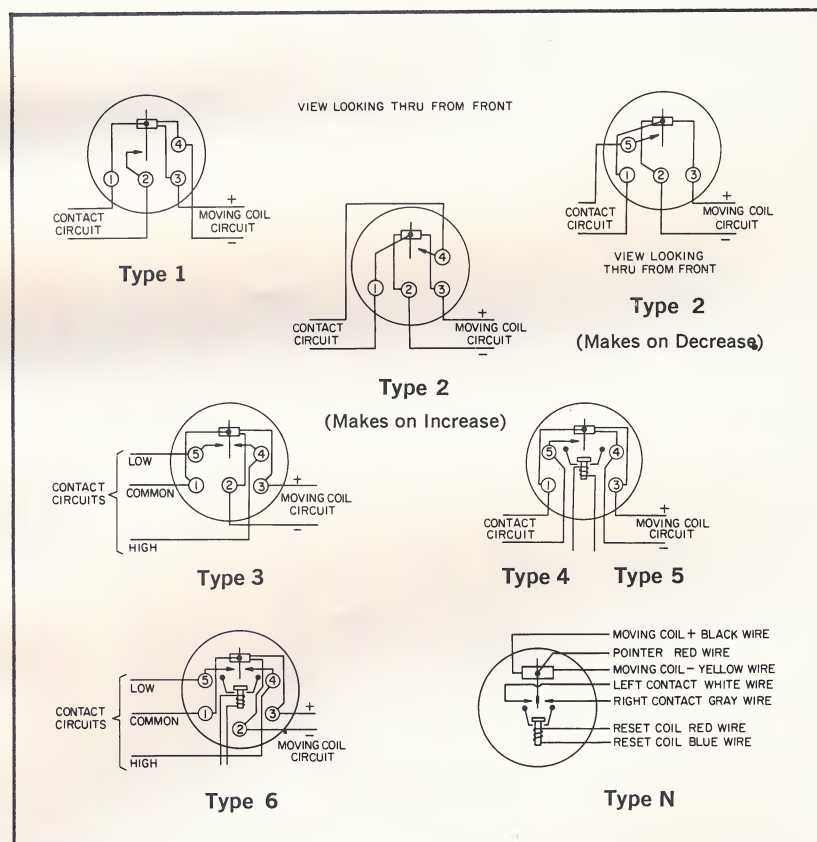


Type 6*—Surface Case



Type N

*Dimensions are also approximate for Types 1, 2, 3, 4 and 5.



(continued)

All dimensional diagrams approximate.

MODEL 705 (continued)

TYPE 1 — Single Fixed Contact — Manual Reset		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0-10 μa	2,300	\$93.95

TYPE 2S (Continued)			
D-C Range	Resistance Ohms $\pm 20\%$	Price	
0-150 μa	60	\$102.65	
0-200 μa	60	↓	
0-300 μa	13		
0-500 μa	13		
0-1 ma	10		
0-50 mv	1,000 Ω/v		
0-1 v	1,000 Ω/v		
0-100 v	1,000 Ω/v		94.65
		104.85	
		104.85	
		104.85	
TYPE 3 — Double Adjustable Contacts — Manual Resets			
D-C Range	Resistance Ohms $\pm 20\%$	Price	
0-10 μa	2,300	\$98.10	
0-20 μa	2,300	↓	
0-30 μa	2,300		
0-40 μa	1,040		
0-50 μa	525		
0-80 μa	525		
0-100 μa	525		
0-150 μa	60		
0-200 μa	60		
0-300 μa	13		
0-500 μa	13		
0-1 ma	10		
0-50 mv	1,000 Ω/v		
0-1 v	1,000 Ω/v		
0-100 v	1,000 Ω/v		
			90.10
		100.50	
		100.50	
		100.50	
*TYPE 3S — Double Adjustable Contacts — Manual Reset			
D-C Range	Resistance Ohms $\pm 20\%$	Price	
0-10 μa	2,300	\$109.25	
0-20 μa	2,300	↓	
0-30 μa	2,300		
0-40 μa	1,040		
0-50 μa	525		
0-80 μa	525		
0-100 μa	525		
0-150 μa	60		
0-200 μa	60		
0-300 μa	13		
0-500 μa	13		
0-1 ma	10		
0-50 mv	1,000 Ω/v		
0-100 v	1,000 Ω/v		
			101.25
			111.40
		111.40	

*Has separate contact and adjustable reset controls.

Note: All resistance values are approximate.

For unlisted ranges add \$2.00 list to next highest range.

TYPE 4 — Single Contact Solenoid Reset		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0-5 μa	2,300	\$99.15 ↓
0-10 μa	2,300	
0-20 μa	525	
0-30 μa	525	
0-40 μa	525	
0-50 μa	60	
0-80 μa	60	
0-100 μa	60	
0-150 μa	13	
0-200 μa	13	
0-300 μa	13	
0-500 μa	13	
0-1 ma	10	91.95
0-50 mv	1,000 Ω/v	101.35
0-1 v	1,000 Ω/v	101.35
0-100 v	1,000 Ω/v	101.35
TYPE 5 — Single Contact Solenoid Reset and Adjustable Operating Point		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0-5 μa	2,300	\$101.35 ↓
0-10 μa	2,300	
0-20 μa	525	
0-30 μa	525	
0-40 μa	525	
0-50 μa	60	
0-80 μa	60	
0-100 μa	60	
0-150 μa	13	
0-200 μa	13	
0-300 μa	13	
0-500 μa	13	
0-1 ma	10	93.35

TYPE 5 (Continued)		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0-50 mv	1,000 Ω/v	\$103.55
0-1 v	1,000 Ω/v	103.55
0-100 v	1,000 Ω/v	103.55
TYPE 6 — Double Contact Solenoid Reset		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0-5 μa	2,300	\$103.55 ↓
0-10 μa	2,300	
0-20 μa	525	
0-30 μa	525	
0-40 μa	60	
0-50 μa	60	
0-80 μa	60	
0-100 μa	13	
0-150 μa	13	
0-200 μa	13	
0-300 μa	13	
0-500 μa	13	
0-1 ma	10	95.55
0-50 mv	1,000 Ω/v	105.75
0-1 v	1,000 Ω/v	105.75
0-100 v	1,000 Ω/v	105.75
TYPE N — Double Contact with Solenoid Reset Reset is 6 volt d-c or 120 volt a-c		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0.5-0.5 μa	7,400	\$120.15.
1-0.1 μa	2,300	115.25

Note: All resistance values are approximate.
For unlisted ranges add \$2.00 list to next highest range.

A-C RELAYS

Ranges	Type 1	Type 2	Type 2-S	Type 3	Type 3-S	Type 4*	Type 5*	Type 6*
10 microamperes up to 10 milliamperes	\$105.75	\$107.90	\$114.45	\$110.10	\$121.00	\$110.95	\$113.50	\$115.35
0.5 volt up to 150 volts	107.00	109.25	115.75	111.40	122.30	112.25	114.50	116.65

External box containing rectifier or resistance and rectifier supplied with all a-c relays.

Temperature Relays

Ranges	Type 1	Type 2	Type 2-S	Type 3	Type 3-S	Type 4*	Type 5*	Type 6*
State range required in °F. or °C., cold end temperature, resistance and material of couple, and leads to be used with the relay	\$ 96.10	\$ 98.10	\$104.85	\$100.50	\$111.40	\$101.35	\$103.55	\$105.75
Adjusted for use with the following and other standard thermocouples: Iron-Constantan, Copper-Constantan, Chromel-Copel, Chromel-Alumel and Platinum 10% Rhodium. (Thermocouples not supplied.)								

6 volt d-c or 120 volt a-c solenoid is standard. Special voltage solenoids available at a surcharge of \$6.55.

sealed sensitrol[®] relay

MODEL 723

GENERAL: Model 723 is a sealed SENSITROL type relay incorporating a self-shielded core magnet mechanism and built-in electrical reset device. Standard reset voltage is 6 volts d-c or 120 volts a-c. Reset time is $\frac{1}{8}$ second maximum at rated voltage. Other special reset voltages are available at a surcharge.

RANGES: See listing.

ACCURACY: $\pm 5\%$ of span.

SCALE: Standard angle is 25° for single contact; for double contact angle is 18° .

CONTACTS-TWINTACTS[®] (pairs of adjacent parallel magnetic contacts): contact capacity is 100 milliamperes at 115 volts a-c or d-c.

ZERO SUPPRESSION: 4 to 10 scale lengths, depending on range.

CASE STYLE: Flush, metal.

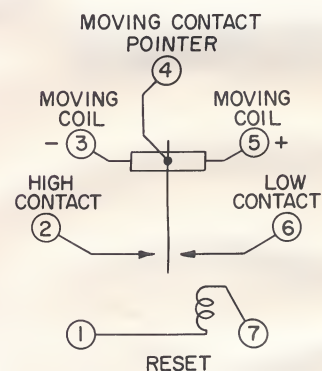
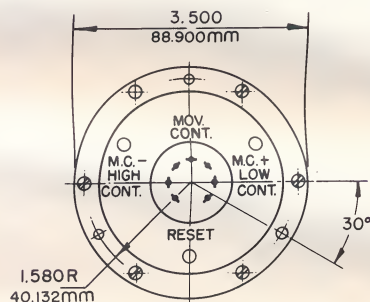
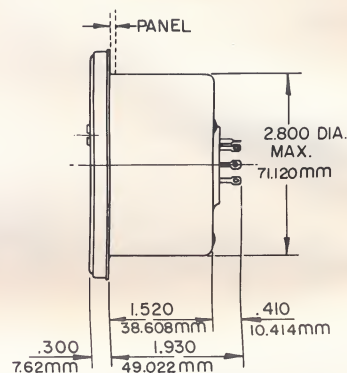
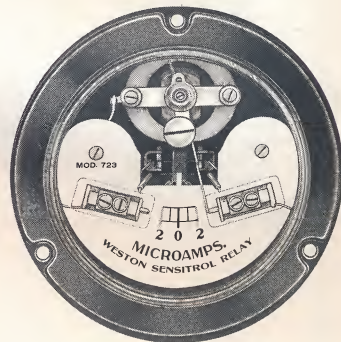
MOUNTING: Vertical panel mounting is standard.

RESISTANCE: See Range listing.

DIELECTRIC: Between circuits 500 volts rms. All terminals tied together to case 1000 volts rms. At a surcharge, 1750 volts rms can be provided.

APPROX. WEIGHT: 10.5 ozs.

TERMINALS: Solder type.



View from Back

SINGLE CONTACT TYPE		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0-1 μa^*	10,400	\$105.50
0-2 μa	10,400	105.50
0-5 μa	4,200	99.40
0-10 μa	2,300	99.40
0-20 μa	450	99.40
0-50 μa	125	99.40
0-100 μa	31	99.40
0-500 μa	9	99.40
0-1 ma	2.2	96.50
0-2 ma	2.0	96.50
0-5 ma	2.0	96.50
0-1 v	1,000 Ω/v	99.40
0-100 v	1,000 Ω/v	99.40
0-5 mv	1,000 Ω/v	99.40
0-10 mv	1,000 Ω/v	99.40
0-50 mv	1,000 Ω/v	99.40

*The 0-1 μa range for use in horizontal position only; scale angle is 16° .

DOUBLE CONTACT TYPE		
D-C Range	Resistance Ohms $\pm 20\%$	Price
0.5-0-0.5 $\mu a^{*†}$	10,400	\$109.90
1-0-1 μa^*	6,800	109.90
2-0-2 μa^*	4,100	103.75
5-0-5 μa	1,200	103.75
10-0-10 μa	450	103.75
20-0-20 μa	115	103.75
50-0-50 μa	31	103.75
100-0-100 μa	8.1	103.75
500-0-500 μa	2.2	103.75
1-0-1 ma	2.0	101.25
2-0-2 ma	2.0	101.25
5-0-5 ma	2.0	101.25
2-0-2 mv	2,000 Ω/v	103.75
5-0-5 mv	1,000 Ω/v	103.75
50-0-50 mv	1,000 Ω/v	103.75
1-0-1 v	1,000 Ω/v	103.75
100-0-100 v	1,000 Ω/v	103.75

*Ranges below 2-0-2 μa , for use in horizontal position only.
†Scale is 16° .

A-C RANGES	SINGLE CONTACT	DOUBLE CONTACT
5 mics up to 10 ma, a-c	\$103.75	\$108.10
$\frac{1}{2}$ volt up to 100 volts a-c	107.25	111.60
100 volts a-c up to 500 volts a-c	107.25 plus 1.50 per 100 volts or fraction thereof	111.60 plus 1.50 per 100 volts or fraction thereof
**°F or °C	103.75	108.10

**State range required, cold end temperature, resistance, and material of thermocouple and leads to be used with the relay.

The model 723 is supplied with a 6 volt D-C, or 120 volts A-C solenoid reset as standard. Other solenoid voltages are available at a surcharge of \$6.55.

For unlisted ranges add \$2.00 list to next highest range.
All dimensional diagrams approximate.

miniature sensitrol® relay

MODEL 813

GENERAL: The miniature Model 813, modern and compact, provides many advantages of other relays, with added versatility and ruggedness. With the addition of spring-back jewels it is more reliable than ever and its small size, light weight and tested sturdiness make this relay adaptable for airborne, marine, and portable uses as well as switchboard applications.

RANGES: The ranges shown in the listing are self-contained. Contact the factory for extension of current or voltage ranges since external resistors or shunts may be required. External rectifiers can be supplied for high-level a-c voltage operation, and internal rectification is available for low level applications.

ACCURACY: 10% of span.

SCALE: Angle is 15° (0.3").

CONTACTS: Contact capacity is 100 milliamperes at 115 volts either a-c or d-c. A magnetic tip on the pointer is the moving contact. It is supplied with one or two permanently magnetized stationary contact assemblies at one or both ends of the indicating scale.

Configurations available: Single magnetic contact with manual push-button or solenoid reset; double magnetic contact with manual or solenoid reset.

ZERO SUPPRESSION: Approximately 10 scale lengths depending upon contact setting.

CASE STYLE: Base is thermosetting plastic, and cover is transparent plastic. Zero corrector can be supplied.

MOUNTING: Surface type, front connected; unless otherwise specified, Model 813 is adjusted for vertical mounting.

RESISTANCE: See Range listing.

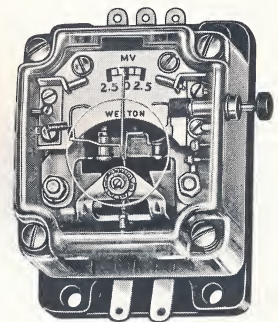
DIELECTRIC: Single and double contact—500 volts rms between moving coil circuit and contact circuit (test).

SOLENOID RESETS: Standard solenoid is intended for intermittent energization:

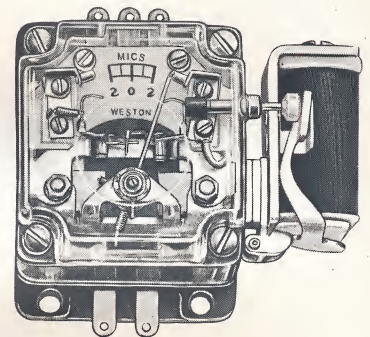
<u>Voltage</u>	<u>Resis. ± 20%</u>		<u>Voltage</u>	<u>Resis. ± 20%</u>
6 volts d-c	10 ohms		24 volts d-c	140 ohms
12 volts d-c	36 ohms		115 volts a-c	1,070 ohms

APPROX. WEIGHT: 5 oz. (0.14 kg.).

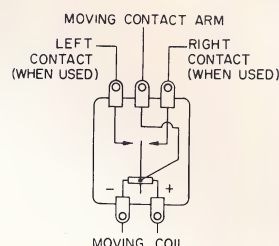
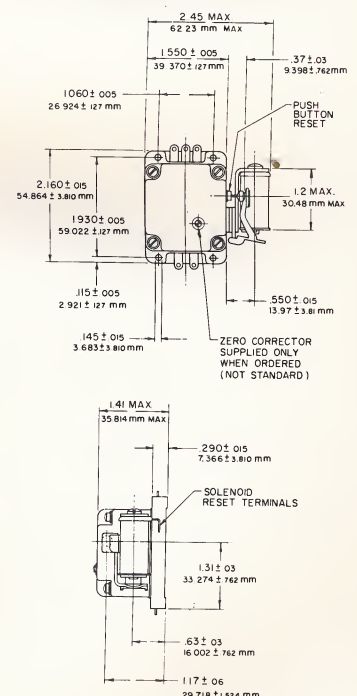
TERMINALS: Solder type.



Double Contacts with Push-Button.



Double Contacts with Solenoid.



Front View

All dimensional diagrams approximate.

(continued)

MODEL 813 (continued)

SINGLE CONTACT TYPE					
D-C Range	Resistance Ohms $\pm 20\%$	CATNO	Price* (Manual Reset)	CATNO	Price* (Solenoid Reset)
0-5 μa	3,000	813-9901001	\$46.75	813-9903001	\$53.30
0-10 μa	3,150	—	46.75	813-9903002	53.30
0-50 μa	140	—	44.00	—	50.55
0-100 μa	43	—	43.00	—	49.55
0-200 μa	12	—	43.00	—	49.55
0-500 μa	5.6	—	43.00	—	49.55
0-1 ma	2.6	—	42.00	—	48.55
0-2 ma	2.1	—	42.00	—	48.55
0-5 ma	2.1	—	42.00	—	48.55
0-10 ma	2.1	—	42.00	—	48.55
0-1 v	1,000 Ω/v	—	45.00	—	51.55
0-100 v	1,000 Ω/v	—	45.00	—	51.55
0-10 mv	—	—	53.00	—	59.55
0-50 mv	—	—	45.00	—	51.55

DOUBLE CONTACT TYPE					
D-C Range	Resistance Ohms $\pm 20\%$	CATNO	Price* (Manual Reset)	CATNO	Price* (Solenoid Reset)
2-0-2 μa	3,150	—	\$48.95	813-9967002	\$55.50
5-0-5 μa	1,700	—	48.95	—	55.50
10-0-10 μa	555	—	45.45	—	52.00
20-0-20 μa	140	—	45.45	—	52.00
50-0-50 μa	28	—	44.45	—	51.00
100-0-100 μa	12	—	44.45	—	51.00
500-0-500 μa	2.6	—	43.45	—	50.00
1-0-1 ma	2.1	—	43.25	—	49.80
2-0-2 ma	2.1	—	43.25	—	49.80
5-0-5 ma	2.1	—	43.25	—	49.80
1-0-1 v	1,000 Ω/v	—	45.70	—	52.25
100-0-100 v	1,000 Ω/v	—	45.70	—	52.25
5-0-5 mv	—	—	54.25	—	60.80
50-0-50 mv	—	—	46.25	—	52.80

Zero corrector can be supplied at \$6.50 additional.

*For 6, 12, 24 volt DC or 115 volt AC; add \$6.55 list for other voltages.
For unlisted ranges add \$2.00 list to next highest range.

miniature sensitrol[®] relay

MODEL 1085

GENERAL: Model 1085 relay is a SENSITROL type using magnetic contacts. It can be supplied as a single contact relay to make on increasing or decreasing current or with double contacts as a zero center relay. The semi-core magnet mechanism allows room for an electrical reset device to be mounted beneath the scale; thus, the complete relay and reset are enclosed in the high temperature resistant plastic case.

RANGE: See listing.

ACCURACY: $\pm 10\%$ of span value; repeatability is $\pm 1\%$.

DEFLECTION: 20° - 25° ($0.3''$).

CONTACTS: Contacts are rated at 100 milliamperes at 115 volts a-c or d-c. Double contact type is provided in zero center ranges with resistance as listed for a given sensitivity span.

SOLENOID RESET: Available in 6, 8, 12 or 24 volts d-c as standard for self-contained reset solenoid. Other voltages are available. 115 volts a-c supplied at \$4.00 extra.

ZERO SUPPRESSION: Up to 5 times normal deflection (depending on range).

CASE STYLE: Base is thermosetting plastic, with cover of high temperature (80°C) molded plastic. Base-to-cover gasket provides a tight seal.

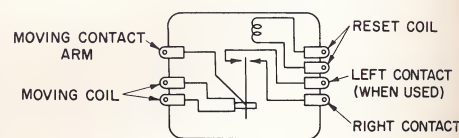
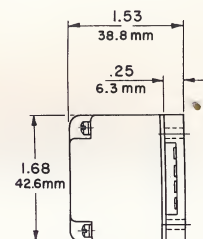
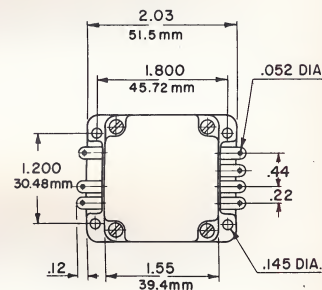
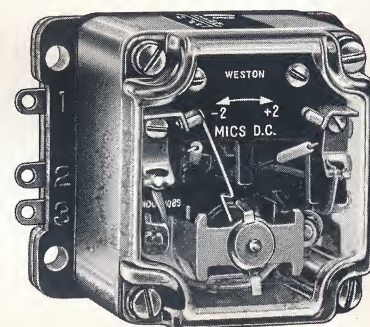
MOUNTING: Vertical is standard.

RESISTANCE: See Range listing.

DIELECTRIC: 500 volts rms between circuits (test).

APPROX. WEIGHT: 14 oz.

TERMINALS: Solder type terminals are molded in the base.



Front View

SINGLE and DOUBLE CONTACT TYPES			
D-C Range	Resistance Ohms $\pm 20\%$	Price	
		Single Contact	Double Contact
2-0-2 μa	3,000	\$63.50	\$66.50
0-10 μa	2,300	\$63.50	\$66.50
0-20 μa	1,700	63.50	66.50
0-50 μa	525	60.50	63.50
0-100 μa	68	60.50	63.50
0-200 μa	40	60.50	63.50
0-500 μa	20	60.50	63.50
0-1 ma	3.6	57.00	60.00
0-50 v	1,000 Ω/v	65.50	68.00
0-100 v	1,000 Ω/v	67.50	70.00

For unlisted ranges add \$2.00 list to next highest range.

All dimensional diagrams approximate.

all purpose sensitrol[®] relay

MODEL 1092

GENERAL: Model 1092 is an all purpose SENSITROL (magnetic contacts) relay at an unusually attractive price. This relay is available in a single adjustable range. It is the ideal relay for solving alarm or control problems, particularly in the development stage and its wide range of adjustment will permit an almost infinite number of accurately repeatable settings by the simple turn of one adjusting screw. Throttling action is provided by pulsing circuits which eliminate troublesome overshoot in many control applications. For "on-off" control, a simple setting can be made to hold such variables as temperature, voltage or light level constant within very narrow limits.

As a demonstration unit for classroom or commercial display work, its flexibility can't be matched. Two of these inexpensive SENSITROLS connected in opposition will provide close high-low control adjustability over a wide span by means of a simple screwdriver adjustment.

DUTY: Continuous.

SENSITIVITY: 0-50 μ a, adjustable.

CONTACTS: Magnetic—100 ma at 115 v a-c or d-c.

DC MOVING COIL RESISTANCE: 2300 ohms $\pm$ 20%.

MOVING COIL POWER CONSUMPTION: .006 milliwatts @ 50 μ a.

OVERLOAD: 500 microamperes.

RESPONSE TIME: 0.5 seconds approximately with 10% overload.

DIELECTRIC: 500 volts rms test between circuits and between terminals and case.

INSULATION: 100 megohms minimum at 100 volts d-c between circuits and between terminals and case.

RESET VOLTAGE: 115 volts a-c, continuous.

RESET COIL POWER: Approx. 1 watt at 115 volts a-c.

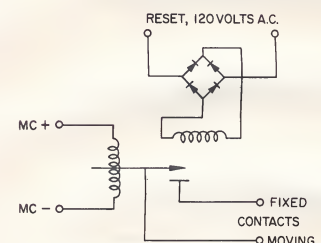
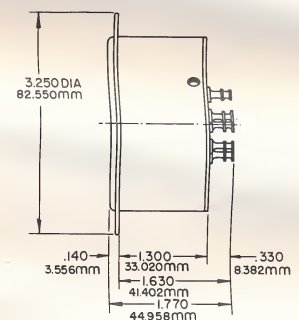
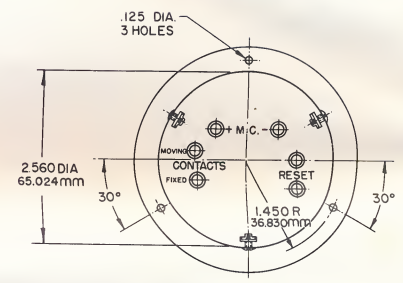
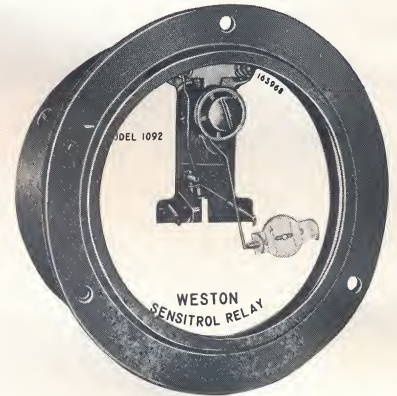
RESET TIME: $\frac{1}{4}$ second—max.

LIFE: 1,000,000 operations minimum.

APPROX. WEIGHT: 0.3 lb.

PRICE: CATNO. 1092-9901001s\$30.40

s—Normally carried in stock.



LCCA relays

MODEL 1073

GENERAL: This Magtrak relay combines the high sensitivity of d-c permanent magnet indicating instruments, the reliability of magnetic contacts, and the locking and resetting features of the load current contact aiding type. Model 1073 features powerful initial contact pressure (100 times greater than most relays), fast make and break, single push button reset on front, set points readily adjustable and an auxiliary control package as a plug-in unit for remote mounting.

RANGES: See listing.

ACCURACY: (at normal room temperature) DC; 2% as indicator, 3% on contact (will normally repeat contact point at better than 1% if conditions are duplicated).

SCALE: 3.47".

CONTACT ADJUSTMENT: Hand or screwdriver adjustable.

CONTACT ARRANGEMENT: High, low or both.

CONTACT RATING: 10 to 25 milliamperes at 6 to 150 volts d-c.

AIDING COIL RESISTANCE: Standard aiding coil resistance is 68 ohms.

CONTACT AIDING COIL ARRANGEMENTS:

1. Single aiding coil with one side common with sensing coil.
2. Single aiding coil completely isolated from sensing coil.
3. Two aiding coils, with one point common with both, but isolated from sensing coil.
4. Two aiding coils, with each coil common to sensing coil.

ISOLATION: Normally 70 volts d-c.

CASE STYLE: Black Bakelite front with glass window; cadmium plated steel case with screwdriver operated zero corrector.

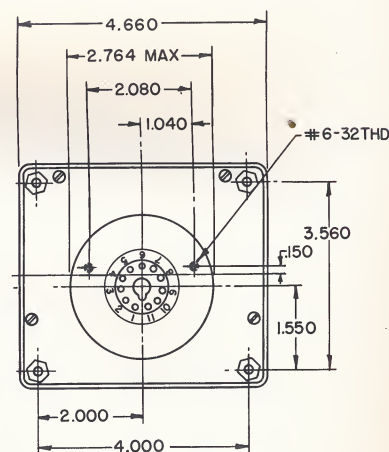
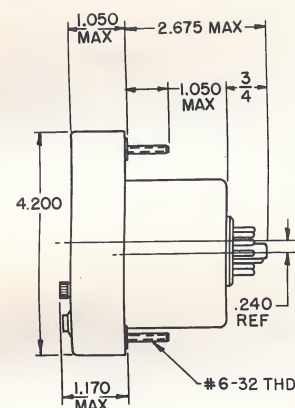
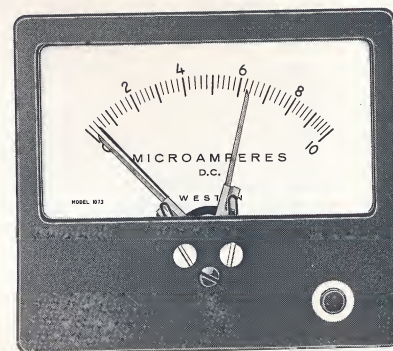
MOUNTING: Vertical panel mounting is standard.

RESISTANCE: See Range listing.

DIELECTRIC: 3000 volts between all circuits tied together and case (test). 70 volts rms between individual circuits.

APPROX. WEIGHT: 1½ lbs.

TERMINALS: 11 pin plug connector mates with AMPHENOL No. 78-S11 socket or equivalent.



RANGES					
For Rectifier Type A-C Insts. — Add \$10.00 to Prices Listed Below					
Range	Resistance — Ohms (± 20%)	Single High Contact CATNO	Price	DBL. High and Low Contacts Single Aiding Coil CATNO	Price
0-10 μ a	10,000	1073-5602010	\$80.00	1073-5601010	\$87.25
0-20 μ a	10,000	—	73.00	—	80.25
0-50 μ a	3,700	1073-5602050	70.50	1073-5601050s	77.75
0-100 μ a	1,360	1073-5602100	69.50	1073-5601100s	76.75
0-200 μ a	600	—	69.50	—	—
0-500 μ a	120	1073-5602500	69.50	1073-5601500s	76.75
0-1 ma	35	1073-4602001s	68.50	1073-4601001s	75.75
0-5 ma	4	—	68.50	—	75.75
0-20 ma	1.05	1073-4602020	79.50	1073-4601020	86.75
0-1 amp	0.10	—	81.00	—	88.25
0-20 mv	20	—	86.00	—	93.25
0-50 mv	50	1073-9602050	83.50	1073-9601050s	90.75
0-100 mv	100	1073-9602100	83.50	1073-9601100	90.75
0-10 v	1,000 Ω /v	—	81.00	—	88.25
0-150 v	1,000 Ω /v	—	81.00	—	88.25

PYROMILLIVOLTMETERS (With Cold End Compensation)*				
Dual Scale		Thermo- couple	DBL High and Low Contacts CATNO	Price
Degrees F.	Degrees C.			
0- 750	0- 400*	I/C	—	\$91.00
0-1000	0- 500*	I/C	1073-8601001	91.00
0-1500	0- 800*	I/C	—	87.50
0-2000	0-1100*	C/A	—	87.50
0-2500	0-1370	C/A	1073-8601002s	87.50

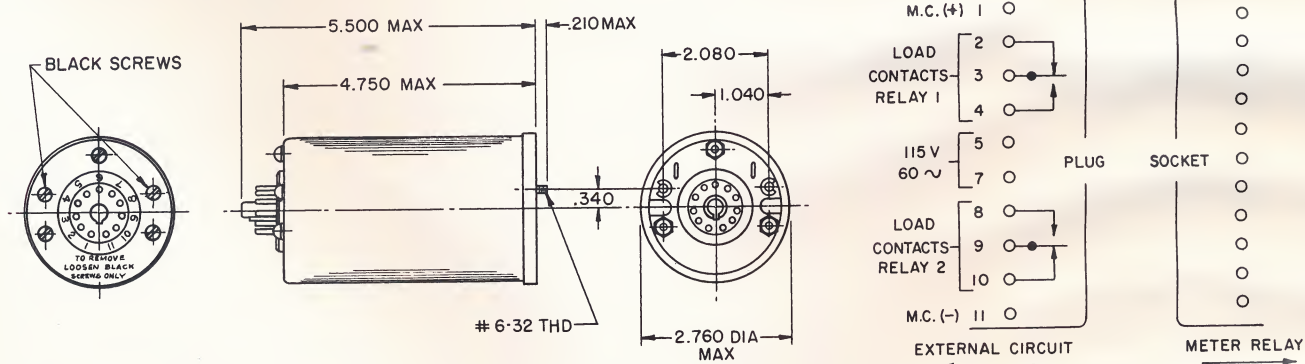
All prices shown above are for instruments with number and type of contacts as indicated, single aiding coil, 70 volt isolation, and do not include the auxiliary control package. Surcharges for these features are shown below:

Feature	Price
Additional Contact.....	\$ 7.25
Additional Aiding Coil.....	8.00
*70 Volt Isolation Standard—No Charge; above 70 volts	Price on Application
*Weston does not supply thermocouples. When thermocouples other than listed are used, specify type used. Lead resistance is calculated at 10 ohms. Customer must provide 10 ohms, or specify exact lead resistance on special order.	

AUXILIARY CONTROL PACKAGE MODEL 9820

The Model 1073 MagTrak relay offers as an optional feature a plug-in unit consisting of a solid-state rectifier and filter circuit to provide the necessary voltage for the contact aiding circuit. It also contains power relays with a contact current carrying capacity of 5 amperes at 220 volts to perform the switching operation for the actuating circuit. The Control Package may be plugged into the back of the relay or mounted remotely. Both the relay and Control Package are provided with eleven-pin plug connectors which accommodate commercially available sockets.

Control Package
(Model 9820) (CATNO 9900001s) . . . \$38.00



s—Normally carried in stock. For unlisted ranges add \$2.00 list to next highest range.

All dimensional diagrams approximate.

2½" sealed ruggedized relay

MODEL 1093

GENERAL: This sealed, ruggedized LCCA instrument relay is particularly suited for alarm systems or for circuits with slowly changing inputs. Featuring a long scale and better dependability than non-locking types. This model meets the requirements of MIL-M-10304 as a meter only, with the following exceptions:

1. *Response time* (This will generally be slower than the mil spec requirement because meter-relays should be over-damped).
2. *Dielectric Test* = 1500 Volts, A.C. between all terminals tied together and the case and 70 Volts, A.C. between contact circuit and signal circuit.
3. *Random Drop* — This test is deleted.
4. *Shock* — Per MIL-STD-202, Method 202B *only*, with the following conditions: 50g's, with 10 blows in each of three positions.
5. *Initial Accuracy* — Per spec. as a meter; $\pm 3\%$ of full scale contact accuracy.

RANGES: See listing.

ACCURACY: (at 25°C) DC: 2% of full scale as indicator, 3%* of full scale on contact (Note—will normally repeat contact point at better than 2% of full scale if conditions are duplicated).

SCALE: 100 degrees; approx. 1.8 inches; for ranges of 50 microamps and over. The 20 μ a range has an 86° scale angle (1.55").

CONTACTS: Two independently adjustable (or preset) contacts. Single adjustable (or preset) contact, to close on either increasing or decreasing current.

Adjustable contacts have knurled and slotted adjusting knobs, suitable for hand or screwdriver adjustment.

Standard aiding coil: 5-25 ma d-c at 24 to 125 volts d-c, unless otherwise ordered will be supplied at 10 ma at 24 volts d-c. Contact ratings as high as 300 ma can be supplied; however, correspondence is necessary due to possible changes in the aiding coil and/or voltage rating. Preset contacts are not accessible.

CONTACT AIDING COIL ARRANGEMENTS:

Type 5 — single aiding coil, isolated from sensing coil.

Type 6 — two aiding coils, with one point common to both, but isolated from sensing coil.

Type 6c — two aiding coils, with each coil common to sensing coil.

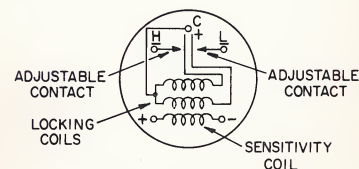
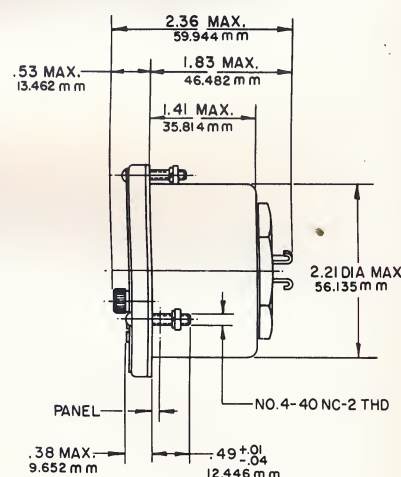
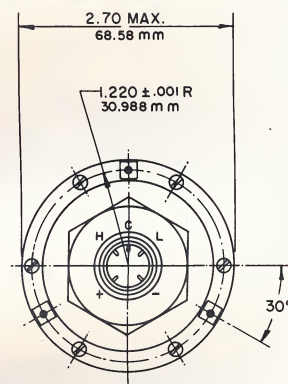
ZERO SUPPRESSION: one (1) to two (2) scale lengths, depending on range.

CASE STYLE: sealed round flush mounting, metal case with plastic window; sealed zero corrector, screwdriver operated.

MOUNTING: Vertical panel mounting is standard.

(continued)

*Standard units have contacts adjusted for 10 ma at 24 volts d-c. For best accuracy on sensitive ranges, customers should specify contact current and source voltage.



View from Back

All dimensional diagrams approximate.

MODEL 1093 (continued)

RESISTANCE: See Range listing.

ISOLATION: 70 volts rms between circuits is standard (continuous).

DIELECTRIC: 1500 volts d-c between all circuits tied together and case (test).

APPROX. WEIGHT: 10.5 oz.

TERMINALS: All connections are made to a sealed header with solder type terminals.

RANGES *

D-C Range	Resistance Ohms $\pm 20\%$	Price**
0-20 μ a	4,650	\$66.50
0-50 μ a	3,000	61.00
0-100 μ a	3,000	61.00
0-200 μ a	900	61.00
0-500 μ a	110	61.00
0-1 ma	43	61.00
0-2 ma	22	61.00
0-20 ma	2.5	61.00
0-50 ma	1.0	61.00
0-100 ma	0.5	61.00
0-10 v	1,000 Ω/v	61.50
0-150 v	1,000 Ω/v	64.50
0-50 mv	12.5	61.50
0-100 mv	25	61.50

*Current ranges up to one (1) ampere can be provided self-contained at 75 mv drop maximum.

**Prices shown are relays with single aiding coil, single adjustable contact and 70 volts isolation.

SURCHARGES

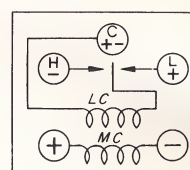
Additional Contact	\$ 6.95
Additional Locking Coil	4.35
Suppressed Zero	4.35
Rectifier Type	10.00
Isolation between sensing coil and locking coil:	
above 70 volts to 200 volts, d-c continuous	\$13.25

For unlisted ranges add \$2.00 list to next highest range.

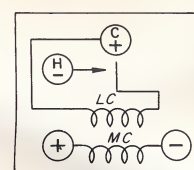
INTERNAL WIRING DIAGRAMS

LC = locking coil

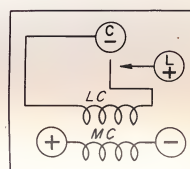
MC = moving coil



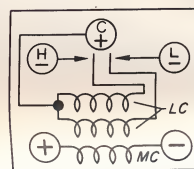
Type 5



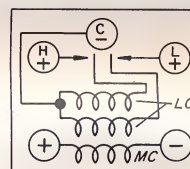
Type 5H



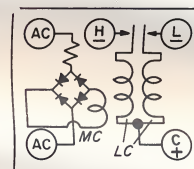
Type 5L



Type 6



Type 6A



Rectifier Type.

3½" sealed ruggedized relay

MODEL 1097

GENERAL: Model 1097 is a 3½" round, sealed, ruggedized relay featuring the time tested reliability of the load current contact aiding (or locking) coil. Although similar to Model 1093, this relay has the advantage of longer scale length, improved readability and higher torque mechanism. This model meets the requirements of MIL-M-10304 as a meter only, with the following exceptions:

1. *Response time* (This will generally be slower than the mil spec requirement because meter-relays should be over-damped).
2. *Dielectric Test* = 1500 Volts, A.C. between all terminals tied together and the case and 70 Volts, A.C. between contact circuit and signal circuit.
3. *Random Drop* — This test is deleted.
4. *Shock* — Per MIL-STD-202, Method 202B only, with the following conditions: 50g's, with 10 blows in each of three positions.
5. *Initial Accuracy* — Per spec. as a meter; $\pm 3\%$ of full scale contact accuracy.

RANGE: See listing.

ACCURACY: $\pm 2\%$ of full scale readings as an indicator; $\pm 3\%$ of full scale on contact. Standard units have contacts adjusted for 10 ma, at 24 volts dc for best accuracy, customers should specify contact current and source voltage.

SCALE: 95° — 2.27" arc at pointer tip.

CONTACTS: One or two independently adjustable (or pre-adjusted) contacts to close on increasing or decreasing current, rated at 5 to 25 ma at 24-125 volts d-c. Higher contact ratings (up to 300 ma) available on special order. Adjustable contacts have knurled and slotted adjusting knobs — suitable for hand or screwdriver adjustment.

ZERO SUPPRESSION: Usually one to two scale lengths, depending upon range.

CASE STYLE: Sealed — 3.5" diameter-round flush mounting, metal case with glass window. Zero corrector, screwdriver operated.

MOUNTING: Vertical panel mounting is standard.

RESISTANCE: See Range listing.

ISOLATION: 70 volts rms between circuits is standard (continuous).

DIELECTRIC: 1500 volts rms between all terminals tied together and case (test).

APPROX. WEIGHT: 1.32 lbs. (.598 kgs).

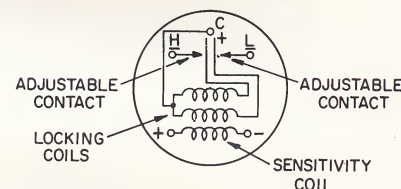
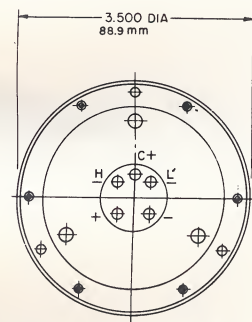
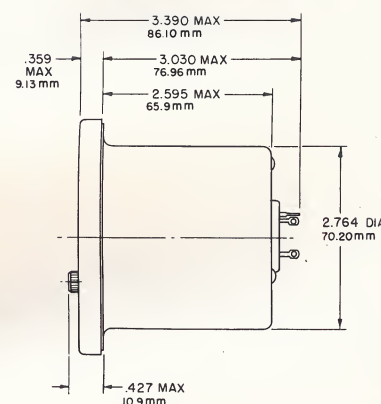
TERMINALS: All connections are made to a sealed header, with solder type terminals.

RANGES

(Prices shown below are for single contact, single aiding coil relays)

D-C Range	Resistance Ohms $\pm 20\%$	Price
0-20 μ a	10,000	\$100.00
0-50 μ a	3,700	96.50
0-100 μ a	1,360	96.50
0-200 μ a	600	94.50
0-500 μ a	120	94.50
0-1 ma	35	91.50
0-5 ma	4	91.50
0-20 ma	1.0	91.50
0-1 amp	0.099	94.50
0-50 mv	50	95.00
0-100 mv	100	92.50
0-10 v	1,000 Ω/v	97.50
0-150 v	1,000 Ω/v	97.50

For unlisted ranges add \$2.00 list to next highest range



View from Back

SURCHARGES

Additional Contact		\$10.00
Additional Aiding Coil		6.25
Suppressed Zero		4.35
Rectifier Type		14.00
Isolation between sensing coil and locking coil: above 70 volts to 200 volts, d-c continuous		\$13.25

All dimensional diagrams approximate.

non-physical contact relay

MODEL 1075

GENERAL: Model 1075 non-physical contact relay uses the Weston taut band external magnet type mechanism. It has a long vane attached to the pointer, photoconductive cells attached to the set pointers, lamps, and a transistor switching circuit. A double ended power supply (Model 9980 Type 1075, page 37) can be provided for use as a voltage source for switching circuits and lamps.

Solid state switching provides ultra reliable contact with no metal-to-metal wear. Continuous reading up or down scale after contact is made and automatic reset are a few of the many features of this versatile relay.

Standard Single High Set Point "In Rest" circuitry operates as follows: Until the pointer reaches the contact set-point, the photocell is illuminated. The "light" resistance of the cell is so connected in the circuitry, as to cut off the transistor and maintain the load relay in an unenergized state.

When the pointer reaches the set-point, the pointer vane covers the cell, cutting off its light source. The "dark" resistance of the cell allows the transistor circuitry to conduct and energize the relay. The load relay remains energized as long as the pointer is at or above the high set-point. As the pointer passes below the high set-point, the photocell is again "lighted", the transistor cut off, and the load relay de-energized.

When required and specified by the customer, "Work Current" circuitry can be provided, whereby the above described operation is reversed. This configuration energizes the load relay until the high set-point is reached.

RANGES: See listing.

MAXIMUM SENSITIVITY: 5 microamperes with 80° scale angle.

ACCURACY: $\pm 2\%$ of full scale for d-c ranges. Set-point accuracy is an additional $\pm 2\%$ of full scale value, and repeatability is 1% maximum (with conditions duplicated). A.C. indicator accuracy $\pm 3\%$ of full scale.

LAMP LIFE: 8000 hours minimum, 30,000 hours nominal when used with Model 9980 Type 1075 Power Supply. Lamps (G.E. #1847), readily accessible from front for replacement purposes.

LOAD RELAY: Model 1074, Type 6 Power Relay — purchased as accessory (see page 38).

LINE VOLTAGE: 115 volts, 60 cycles, ± 10 volts a-c.

SCALE: 95 degrees — 3.47 inches.

ZERO SUPPRESSION: Varies with ranges; $1\frac{1}{4}$ scale lengths maximum.

CIRCUIT: Utilizes one photoconductive cell and transistor switching circuit per set point. (Self-contained.)

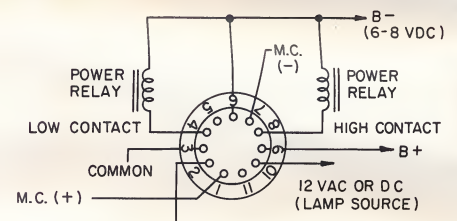
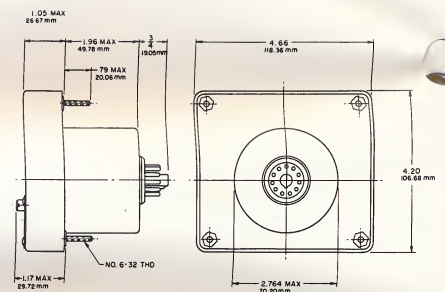
PHOTOCELL: Cadmium Selenide — 1500 ohms resistance when illuminated to a color temperature of 2870°K at 2 foot-candles.

DIELECTRIC: 2,000 volts rms, live circuits to case (test value).

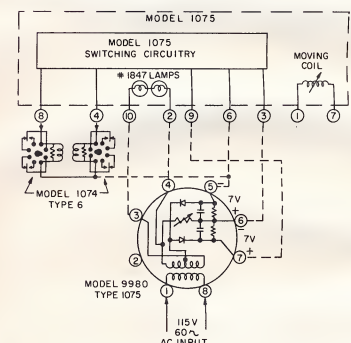
TRANSISTOR: PNP Germanium — power dissipation rating is 120 mw at 25°C.

OPERATING TEMPERATURE: Minus 20°C to plus 50°C.

MOUNTING: Vertical panel mounting is standard.



View from Back



System Interconnection
Wiring Diagram

All dimensional diagrams approximate.

MODEL 1075 (continued)

CASE STYLE: Flush, Bakelite.

POWER SUPPLY REQUIREMENTS*: 6-0-6 volts d-c to 8-0-8 volts d-c at 0-70 ma, and 11.5 volts a-c (± 1.3 volts) at 150 ma. The power supply output must be within this tolerance with an input of 115 volts a-c ($\pm 10\%$) at 60 cycles. The nominal 7-0-7 volts d-c provides circuit polarization and the 11.5 volts a-c is used for lamp illumination.

CONTROL POINT BAND (Difference in Actuation Point, When Pointer is Moving Up or Down Scale.) — Maximum of 1 degree.

MINIMUM SEPARATION: 5 degrees between double set points.

APPROX. WEIGHT: 1.51 lb.

*All power supply requirements are designed into Model 9980 Type 1075. See page 37.

RANGES					
D-C Range	Resistance Ohms $\pm 20\%$	SINGLE SET POINT		DOUBLE SET POINT	
		CATNO	PRICE	CATNO	PRICE
0-10 μ a	6,200	1075-5602010	\$124.00	075-5601010	\$140.00
0-20 μ a	2,500	1075-5602020s	104.25	1075-5601020s	120.25
0-50 μ a	960	1075-5602050s	90.75	1075-5601050s	106.75
0-100 μ a	760	1075-5602100s	84.75	1075-5601100	100.75
0-200 μ a	140	—	78.75	—	94.75
0-500 μ a	30	—	78.75	—	94.75
0-1 ma	12	1075-4602001s	75.50	1075-4601001s	91.50
0-5 ma	2.5	—	75.50	—	91.50
0-20 ma	0.2	1075-4602020	75.50	1075-4601020	91.50
0-1 amp	.050	1075-2602001	81.50	1075-2601001	97.50
0-20 mv	20*	—	80.25	—	96.25
0-50 mv	50*	1075-9602050s	78.75	1075-9601050s	94.75
0-100 mv	100*	—	78.75	—	94.75
0-10 v	1,000 Ω /v	1075-1602010	82.50	1075-1601010	98.50
0-150 v	1,000 Ω /v	1075-1602150	82.50	1075-1601150	98.50
0-500 v	1,000 Ω /v	—	82.50	—	98.50

*Specify external lead resistance if greater than 0.1 ohm.
s—Normally carried in stock.

For unlisted ranges add \$2.00 list to next highest range.

PYROMETERS*				
Temperature Ranges °F °C		Couple	DOUBLE SET POINT	
			CATNO	Price**
0-750†	0-400†	I/C (J)	1075-8601001	\$107.25
0-1000†	0-500†	I/C (J)	1075-8601002	107.25
0-1500†	0-800†	I/C (J)	1075-8601003	105.50
0-2000†	0-1100†	C/A (K)	1075-8601004	104.00
0-2500	0-1370	C/A (K)	1075-8601005	104.00

*All standard Pyrometers calibrated for use with 10 ohm external lead resistance. For particular applications; specify lead resistance.

**Prices do not include thermocouple.

†Bimetallic cold end compensation included.

non-physical contact relay

1930/1940 SERIES

GENERAL: The 1930/1940 Series of relays harmonize with the Weston Series 1900 panel meters. Completely self-contained, these instruments are capable of carrying and interrupting five (5) amperes at 115 volts a-c resistive load when used with the Model 9776 Power Module (see below). Attractively priced, these relays eliminate the problems of contact failure associated with metal contacts through use of a light source and a photoconductive cell. The power relay is normally energized below set point and when the pointer reaches the set point, a vane attached to the pointer blocks the beam of light shining on the cell and thus de-energerizes the power relay. The circuit configuration is shown in the following schematics.

The 1930/1940 Series with the attached Model 9776 Power Module are designated Models 1935 and 1945.

RANGES: See Listing.

MAXIMUM SENSITIVITY: 100 microamperes.

MECHANISM: Weston CORMAG® (core magnet moving coil type)

ACCURACY: $\pm 2\%$ of full scale as an indicator; $\pm 3\%$ of full scale setpoint accuracy in addition to indicator accuracy (including repeatability). AC meter accuracy $\pm 3\%$ of full scale.

LAMP: A1C, high brightness, neon, 25,000 hours nominal life.

LINE VOLTAGE: 115 volts (± 10 volts a-c) 60 cycles.

SCALE: 100 degrees — 2.76" on Model 1930; 3.93" on Model 1940. Note pointer does not read beyond set point.

PHOTOCELL: Cadmium Selenide. Dark resistance 500 K Ω min.; Light resistance 12 K Ω max.

DIELECTRIC: 250 volts rms between circuits; 2500 volts rms between circuits and mounting studs. (These voltages not recommended for continuous use).

OPERATING TEMPERATURE: Minus 20°C to plus 50°C.

CONTROL POINT BAND: (Difference in control point, when photocell is covered and uncovered). Maximum of 2% when operated with Model 9776 Power Module.

LOAD RELAY and ASSOCIATED CIRCUITRY: Provided in Model 9776 Power Module.

CASE: Black Bakelite.

FRONT: Black Bakelite (std) or clear plastic on special order.

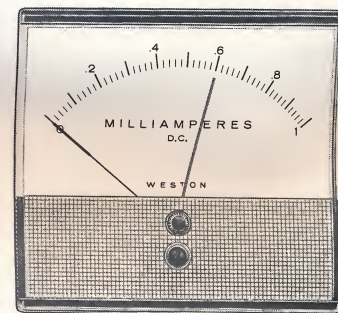
MOUNTING: Vertical panel mounting is standard.

POWER MODULE

GENERAL: The Weston Model 9776 Power Module contains a 115 volt a-c 5 ampere, resistive load single pole, double throw power relay and suitable triggering circuitry for use with Weston Models 1930 and 1940 relays. It is housed in a thermosetting plastic case, and can be panel-mounted in any convenient location for electrical connection to the Model 1930 or 1940. When this unit is furnished mounted directly on the rear of either the Model 1930 or 1940, the combined units are designated as Model 1935 or 1945.

This power module can be used with an external photoconductive cell as a light operated relay. The cell should have characteristics within the operating area as shown in the Resistance vs Deflection curve.

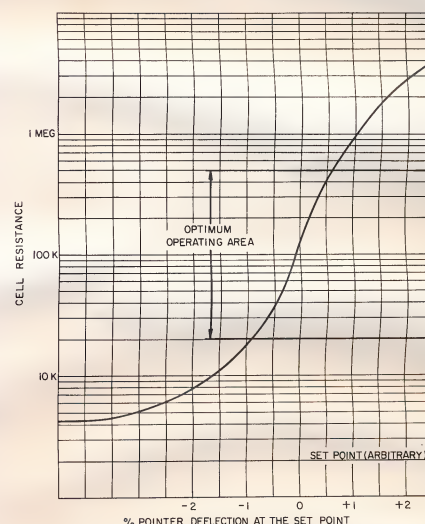
(continued)



Models 1930/1940
with Clear Plastic Front.



Models 1935/1945 with Bakelite
Front and Power Module.



The 1930/1940 may be used to trigger the customer's circuit such as SCR's, etc. Triggering should be within the optimum area of the Resistance vs Deflection curve. The cell is rated for 125 milliwatts at 25°C and should be derated 2.5 mw/°C.

1930/1940 SERIES (continued)

INPUT: 115 volts a-c.

CONTACTS: SPDT 5 amperes 115 volts, 60 cycles a-c or 28 volts d-c (Resistive load).

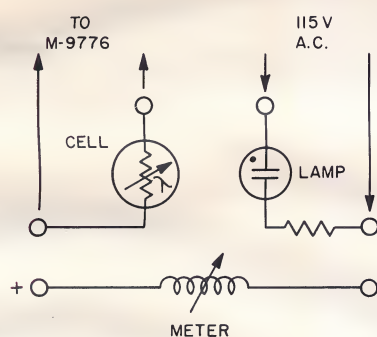
RATED CONTACT LIFE: 100,000 operations minimum.

CATNO 9776-9977600\$32.50

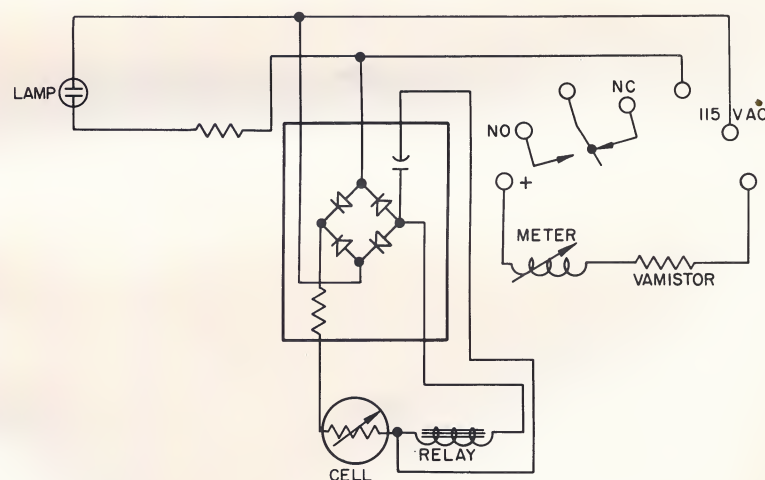
Range	Resistance Ohms $\pm 20\%$	Model 1930		Model 1940		Model 1935		Model 1945	
		CATNO	Price	CATNO	Price	CATNO	Price	CATNO	Price
0-100 μ a	1675	1930-5622100s	\$37.00	1940-5622100s	\$40.00	1935-5622100s	\$70.50	1945-5622100s	\$73.50
0-200 μ a	1180	—	\$37.00	—	\$40.00	—	\$70.50	—	\$73.50
0-500 μ a	140	—	36.00	—	39.00	—	69.50	—	72.50
0-1 ma	53	1930-4622001s	34.00	1940-4622001s	37.00	1935-4622001s	67.50	1945-4622001s	70.50
0-5 ma	3.6	—	34.00	—	37.00	—	67.50	—	70.50
0-10 ma	2.3	—	34.00	—	37.00	—	67.50	—	70.50
0-20 ma	2.2	—	34.00	—	37.00	—	71.50	—	74.50
0-1 amps	50 mv $\pm 10\%$	—	38.00	—	41.00	—	75.50	—	78.50
0-20 mv*	200 Ω /v not copper compensated	—	39.00	—	42.00	—	72.50	—	75.50
0-50 mv*	200 Ω /v	1930-9622050s	36.50	1940-9622050s	39.50	1935-9622050s	70.00	1945-9622050s	73.00
0-100 mv*	200 Ω /v	—	36.50	—	39.50	—	70.00	—	73.00
0-1 v	1,000 Ω /v	—	37.50	—	40.50	—	71.00	—	74.00
0 to 200 v	1,000 Ω /v	—	37.50	—	40.50	—	71.00	—	74.00

*Specify external lead resistance if greater than 0.1 ohm. s-Normally carried in stock. For unlisted ranges add \$2.00 list to next highest range.

All stocked units have black bakelite front and high set pointer.



Models 1930/1940
View from Back

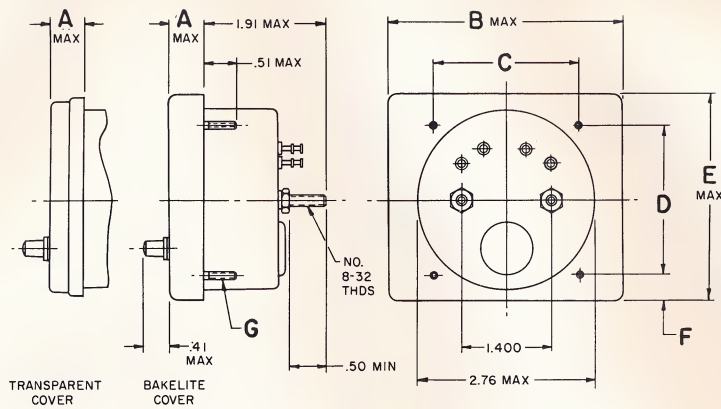


Models 1935/1945
View from Back

(continued)

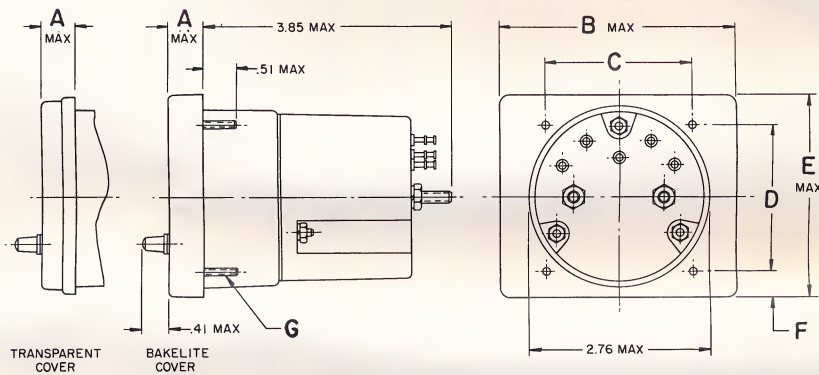
1930/1940 SERIES (continued)

Models 1930/1940

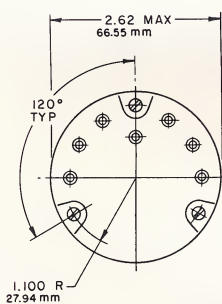


MODEL	COVER	A	B	C	D	E	F	G
1930	TRANSP.	.51	3.51	2.250	2.250	2.99	5/16	NO. 4-40 THDS
	BAKELITE	.56	3.66			3.14	25/64	
1940	TRANSP.	.56	4.53	4.000	3.560	4.07	1/4	NO. 6-32 THDS
	BAKELITE	.56	4.68			4.22	.320	

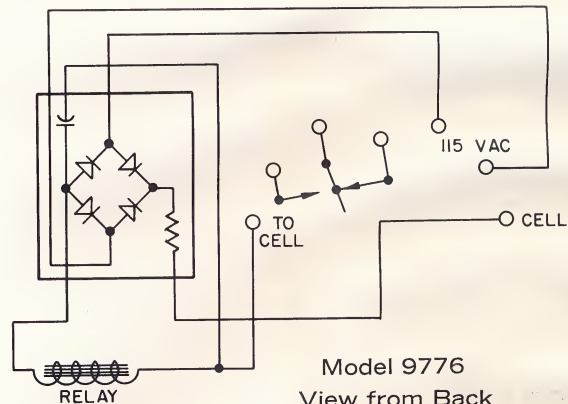
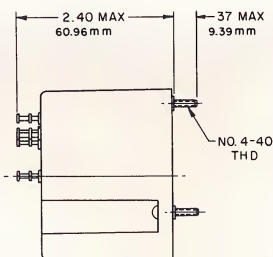
Models 1935/1945
(Includes Power Module)



MODEL	COVER	A	B	C	D	E	F	G
1935	TRANSP.	.51	3.51	2.250	2.250	2.99	5/16	NO. 4-40 THDS
	BAKELITE	.56	3.66			3.14	25/64	
1945	TRANSP.	.56	4.53	4.000	3.560	4.07	1/4	NO. 6-32 THDS
	BAKELITE	.56	4.68			4.22	.320	



Model 9776



Model 9776
View from Back

relay accessories

POWER SUPPLIES

The Weston Model 9980 Power Supply consists of a transformer, resistors, capacitors and silicon diodes, all mounted in a rectangular steel can. A cover, equipped with an octal type plug, is used to provide external mounting means and electrical connections. Available in several types, these power supplies are specifically designed for use with Weston Sensitive and Sensitrol relays.

MODEL 9980 TYPE 6 (Single Power Supply) (For use with Model 1074 Type 6 Power Relay)

INPUT: 115 volts, 60 cycles a-c.

OUTPUT: 6 volts d-c at 200 ma.

APPROX. WEIGHT: 1.21 lbs.

CATNO 9980-9902006s\$20.50

MODEL 9980 TYPE 100 (Double Power Supply) (For use with Model 1074 Type 115 Power Relay)

GENERAL: Three outputs may be obtained from two identical half wave circuits on alternate half cycles or a voltage doubling output when the entire waveform is utilized. Both half-wave voltages cannot be obtained from the power supply simultaneously at rated load.

INPUT: 115 volts, 60 cycles a-c.

OUTPUT: 90 or 180 volts d-c at 75ma.

APPROX. WEIGHT: 1.21 lbs.

CATNO 9980-9902100s\$21.85

MODEL 9980 TYPE 1075

GENERAL: Model 9980 Type 1075 is designed for use with the Model 1075 Non-Physical Contact relay.

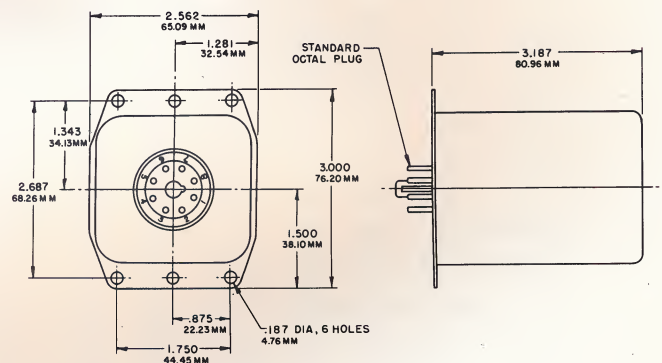
INPUT: 115 volts, 60 cycles a-c.

OUTPUT: 6-0-6 volts to 8-0-8 volts d-c at 78 ma; 11.5 volts a-c (± 1.3 volts) at 150 ma; nominal 7-0-7 volts d-c provides circuit polarization; 11.5 volts a-c is for lamp illumination.

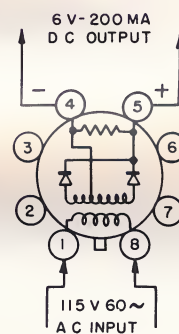
APPROX. WEIGHT: 1.21 lbs.

CATNO 9980-9901075s\$20.50

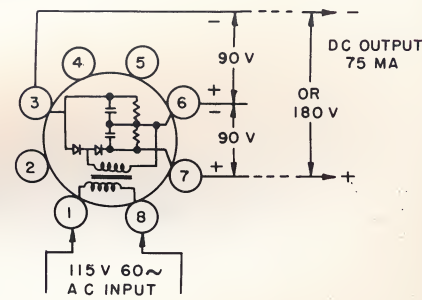
s-Normally carried in stock.



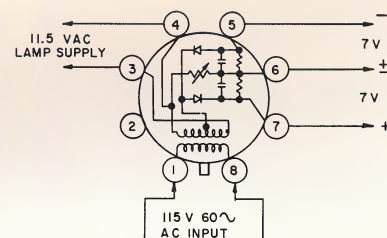
Model 9980 Types 6, 100, 1075



Model 9980 Type 6



Model 9980 Type 100



Model 9980 Type 1075

relay accessories

POWER RELAYS

The Weston Model 1074 Power Relays are of the double pole, double throw type, with contacts rated at 5 amperes, 115 volts a-c or 28 volts d-c, non-inductive. They are of the plug-in type and connection is by standard octal plug.

MODEL 1074 TYPE 6

GENERAL: Use with non-physical contact, magnetic contact, and sensitive contact types.

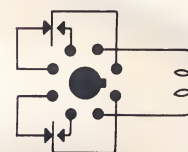
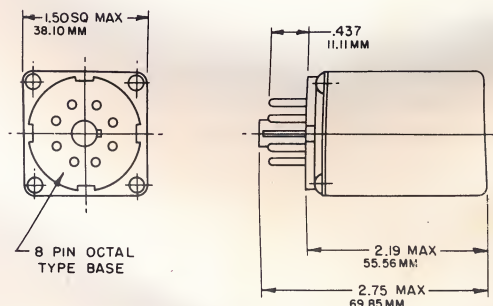
COIL RESISTANCE: 200 ohms.

COIL CURRENT: 35 ma.

COIL VOLTAGE: 6 volts d-c

APPROX. WEIGHT: 0.60 lb.

CATNO 1074-9901006s\$17.50



WIRING DIAGRAM
(UNENERGIZED)

Model 1074 Type 6

MODEL 1074 TYPE 115 A-C

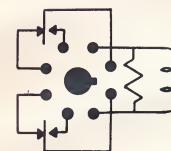
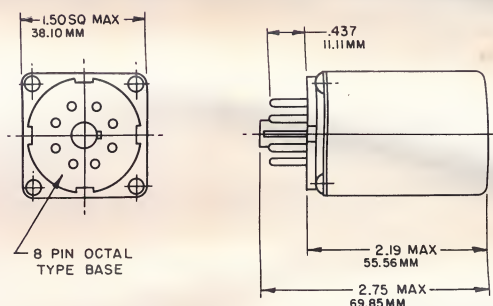
GENERAL: Use with magnetic contact type.

COIL RESISTANCE: 1600 ohms d-c.

COIL CURRENT: 35 ma.

COIL VOLTAGE: 115 volts a-c

CATNO 1074-9902110s\$17.50



WIRING DIAGRAM
(UNENERGIZED)

Model 1074 Types 115 a-c or d-c

MODEL 1074 TYPE 115 D-C

GENERAL: Use with magnetic contact relays Models 705, 723, 813, 1085, 1092; and LCCA relays 1093 and 1097.

COIL RESISTANCE: 6000 ohms.

COIL CURRENT: 20 ma.

COIL VOLTAGE: 115 volts d-c.

CATNO 1074-990110s\$17.50

s-Normally carried in stock.

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